Saskatchewan
Environment

Environmental
Protection
Service

Key Lake Spill
Final Report

March 1984

84- 3091 /

REPORT TO THE MINISTER OF THE ENVIRONMENT ON EVENTS SURROUNDING THE JANUARY 5, 1984 SPILL OF CONTAMINATED PROCESS WATER BY KEY LAKE MINING CORPORATION

Saskatchewan Environment

March, 1984

CONTENTS

Table of Contents		i
List of Appendices		iii
1.	PURPOSE OF REPORT	1
2.	BACKGROUND INFORMATION	1
3.	SPILL EVENT: RESPONSE: PROGRESS	2
	3.1 The Spill	2
	3.2 Response by Saskatchewan Environment	5
	3.2.1 Initial Response	5
	3.2.2 Initial Concerns	5
	3.2.3 Ongoing Efforts	6
	3.2.4 January 11 Instructions to KLMC	8
	3.3 Progress	11
4.	DISCUSSION	13
	4.1 Cause of the Spill	13
	4.2 Impact of the Spill	15
5.	CLEAN-UP AND OTHER REQUIREMENTS	16
	5.1 Clean-up	16
	5.1.1 Considerations	16
	5.1.2 Recommended Clean-up Strategy	19
	5.1.3 Additional Requirements	20
6.	PUBLIC INFORMATION	24
7.	REGULATION AND INSPECTION OF KEY LAKE MINE/MILL COMPLEX	26
	7.1 Provincial and Federal Roles	26
	7.2 Provincial Regulatory Program	28

CONTENTS (continued)

	Page
7.2.1 Summary	28
7.2.2 Legislative Authority	29
7.2.3 The Approvals Process	30
7.2.3.1 Approvals to Construct	30
7.2.3.2 Approvals to Operate	32
7.2.4 Inspections	33
7.2.5 Data Reporting	34
8. CONCLUSIONS AND RECOMMENDATIONS	36

LIST OF APPENDICES

APPENDIX A	Saskatchewan Surface Water Quality Objectives
APPENDIX B	News Releases
APPENDIX C	List of Approvals to Construct
APPENDIX D	Approval to Construct Water Storage Reservoirs and Other Works
APPENDIX E	Approval to Operate
APPENDIX F	1983 Key Lake Inspection Reports

1. PURPOSE OF REPORT

This report has been prepared at the request of the Honourable Neal Hardy, Saskatchewan's Minister of the Environment to provide him with an description of events surrounding the January 5, 1984 spill of contaminated water by Key Lake Mining Corporation (KLMC) and to recommend appropriate clean-up and other measures. Reports by three consultants* to Saskatchewan Environment were used in formulating the recommendations contained herein.

2. BACKGROUND INFORMATION

The Key Lake project is in central northern Saskatchewan about 70 kilometres southeast of Cree Lake at approximately latitude 57 degrees and 11 minutes north and longtitude 105 degrees and 32 minutes. Drainage is to the Wheeler River system which joins with the Gieke River before entering Wollaston Lake about 160 kilometres downstream.

Under a surface lease dated August 27, 1981, KLMC has 3453 hectares of land under lease.

---

*1. Spill and Dyke Erosion Water Storage Reservoir Number 2 Key Lake Mine Site, Saskatchewan, P. Machibroda Engineering Ltd., January, 1984.

2. Key Lake Mining Corporation Uranium Metallurgical Complex, F. Clyde Lendrum Consulting Limited, March, 1984.

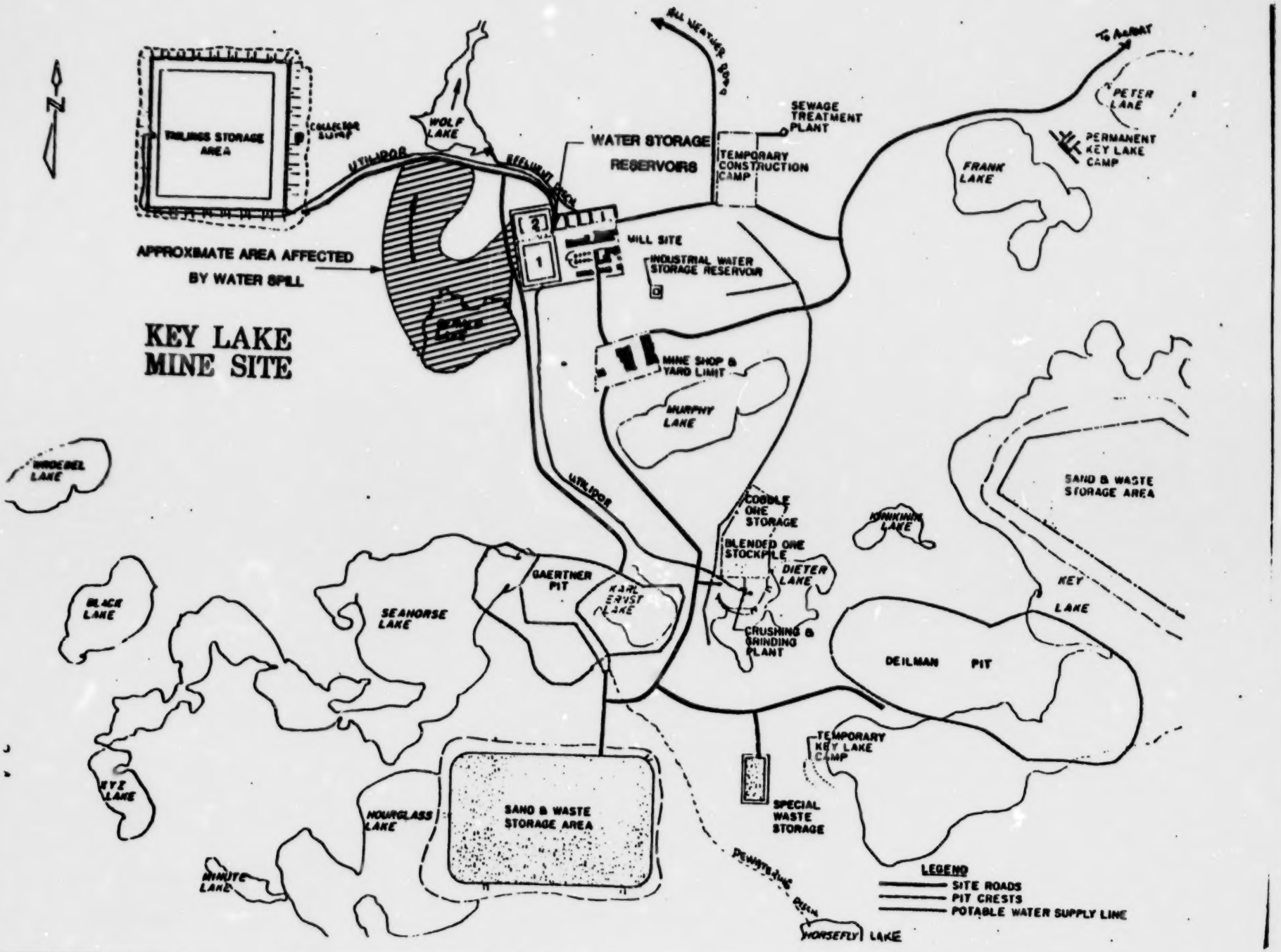
3. Environmental Implications of the Spill From Water Reservoir Number 2 at Key Lake, IEC Beak Consultants Limited, March, 1984.

The project involves development of two open pits to extract ore from the Gaertner and Deilman ore bodies, and a mill where crushed ore is chemically treated to produce yellowcake.

To access the ore bodies in glacial sand and till KLMC has installed a series of dewatering wells and surface water diversions.

Water for processing the ore in the mill is obtained from the bottom of the mine pit(s), decant from the tailings management area and surface runoff from the mill terrace. Two large reservoirs were constructed to hold this water next to the mill. After milling, the water is treated, placed in monitoring ponds and discharged to Wolf Lake. Effluent limits have been established for arsenic, copper, lead, nickel, zinc, total Radium 226, suspended solids and ammonia. The limit for Ra226 is a monthly mean average of 0.37 becquerels per litre (Bq/L) and a maximum grab sample of 1.1 Bq/L. (The Provincial limit is more stringent than the federal limit because total rather than dissolved Ra-226 is measured).

Overall layout of the site is shown on the next page.


KEY LAKE
MINE SITE
TAILINGS STORAGE AREA
COLLECTOR SUMP
WOLF LAKE
WATER STORAGE RESERVOIRS
SEWAGE TREATMENT PLANT
TEMPORARY CONSTRUCTION CAMP
TO AIRSTRIP
PETER LAKE
PERMANENT KEY LAKE CAMP
FRANK LAKE
APPROXIMATE AREA AFFECTED BY WATER SPILL
MILL SITE
INDUSTRIAL WATER STORAGE RESERVOIR
MINE SHOP & YARD LIMIT
MURPHY LAKE
RIDGEBEL LAKE
COBBLE ORE STORAGE
BLENDED ORE STOCKPILE
DIETER LAKE
KINKIMIK LAKE
SAND & WASTE STORAGE AREA
KEY LAKE
GAERTNER PIT
KARL ERVST LAKE
SEAHORSE LAKE
BLACK LAKE
CRUSHING & GRINDING PLANT
DEILMAN PIT
TEMPORARY KEY LAKE CAMP
SPECIAL WASTE STORAGE
EYE LAKE
HOURGLASS LAKE
SAND & WASTE STORAGE AREA
MINUTE LAKE
HORSEFLY LAKE
LEGEND
SITE ROADS
PIT CRESTS
POTABLE WATER SUPPLY LINE

3. SPILL EVENT: RESPONSE: PROGRESS

3.1 The Spill

KLMC advise staff observed water was overflowing Storage Reservoir Number 2 at midnight Wednesday, January 4, 1984. Efforts to stop the flow continued until 1430 Thursday January 5, 1984 at which time the synthetic liner was cut at the breach because water was undercutting the dyke in the direction of Reservoir Number 1. Outflow continued at a reducing rate until 0645 Saturday, January 7, 1984.

There is a fixed weir between the reservoirs and Reservoir Number 1 continued to feed Reservoir Number 2 until 2230 Friday, January 6th. After two ground surveys the calculated volume of water lost was: Reservoir No. 2 - 67 662 m^3 and No. 1 - 19 668 m^3 for a total of 87 330 m^3.

A sample of water was taken by KLMC at 1730 January 5th from the flow from Reservoir No. 2. The analytical results later indicated Ra226, nickel and suspended solids values in excess of the authorized provincial maximum grab sample concentrations for discharge to the environment.

The released water flowed down an incline and onto the ice on a portion of Gerald Lake. Water was also observed to be flowing into a muskeg area. At 1600 hours, January 5th, 1984 water levels were observed to be rising downstream of the

muskeg at a service road to the tailings management area. By 1730 hours the water was encroaching on the road and construction of a berm was initiated by KLMC to prevent overflow into Wolf Lake. No liquid has overflowed or moved beyond the road.

3.2 Response by Saskatchewan Environment

3.2.1 Initial Response

KLMC telephoned the Mines Pollution Control Branch in Prince Albert at around 1030 hours, January 5th. The Spill Control Centre in Regina was alerted and a Mines Pollution Control Branch inspector flown to the site by 1630 hours. The Head of the Waste Management Division, assumed responsiblity for co-ordinating Spill Centre activities and became the Regina spokesperson on the event.

3.2.2 Initial Concerns

After determining all pumps were off and flow contained behind the road concern focused on the integrity of Reservoir Number 1 dyke. The breach in the dyke of Reservoir Number 2 had eroded toward Reservoir Number 1 and the extent of under cutting was not clear.

A geotechnical consultant, P. Machibroda Engineering Limited, was retained by Saskatchewan Environment to

advise on dyke stability. Mr. Machibroda was flown to the site by the Department on January 7 and was satisfied that Reservoir Number 1 was stable and the road (now called the Wolf Dyke) could be made satisfactory. Mr. Machibroda was also asked to:

- assess the cause of the failure;
- assess the proposed repair work on Reservoir Number 2 dyke;
- recommend on future operation of the two reservoirs;
- and estimate spring runoff in the Gerald Lake basin.

3.2.3 Ongoing Efforts

The Mines Pollution Control staff have been on site almost continuously since January 5. Duties have included taking measurements, reporting observations and advising KLMC staff on proposed activities. Their presence was most valuable when some additional problems arose and other spills occurred in the mill complex area.

A second consultant, F. Clyde Lendrum, a metalurgist from Ontario was brought to the site by Saskatchewan Environment to examine and report

on design features to reduce upset conditions in the mill, contingency procedures and means for reducing upset problems. It should be noted that mill design is not usually an area of concern to Saskatchewan Environment and is considered to be the responsibility of the Atomic Energy Control Board (AECB) as an operating concern. However, because some of the upset incidents resulted in flows from the mill building the Department wanted an independent report on this area of concern.

KLMC brought its own dyke consultant to the site. Jeremy Haile of Knight Piezhold Limited, from Vancouver, was to advise the company on the method for reconstructing the breached dyke and the stability of the road. Messrs. Haile and Machibroda were both in agreement on the need to remove water accumulating behind the road (Wolf Dyke) before spring thaw.

Given the uncertainty as to the stability of Number 1 dyke and the road, Saskatchewan Environment raised with KLMC officials the need to consider the possibility of such a failure. It was later determined that the option of raising the all-weather road below Wolf Lake was not considered

viable given the need for KLMC to focus all efforts on the Wolf Dyke and construction of a pipeline to pump water from behind the dyke. KLMC committed itself to pumping Wolf Lake to Reservoir Number 1 if the lake ever became contaminated.

One of the major difficulties encountered by the Department and KLMC was analyses for radionuclides. The KLMC analyzer in the mill was out of service at the time of the spill. Therefore all samples had to be flown to the Saskatchewan Research Council in Saskatoon for analyses. Even when the analyzer was returned to service six days after the spill, the volume of work to be done meant that the SRC had to be extensively utilized for several weeks.

3.2.4 January 11, 1984 Directions to Key Lake Mining Corporation

By January 11, 1984 the situation had clarified itself sufficiently that the following instructions could be issued to KLMC by the Honourable Neal Hardy when he toured the site.

Monitoring

1. Obtain daily water level measurements from the piezometers located in the Reservoir Number 1

and Reservoir Number 2 dykes, specifically SR1-A, SR1-B, SR2-C, SR3-C. Any changes in level to be immediately reported to the Mines Pollution Control Branch. This daily monitoring to continue until all blasting operations in the reservoir area have been completed. Following this, piezometer measurements to be obtained weekly until the end of the current licence period.

2. Water elevations to be measured and reported on a daily basis for Reservoir Number 1 and Reservoir Number 2 until all blasting operations in the vicinity have been completed.
3. Supply to the Mines Pollution Control Branch an "as built" survey of the tailings road dyke.
4. Measure and report:
   (a) water level behind tailings road dykes as of January 11, 1984; and
   (b) water level behind tailings road dyke upon completion of retrieval pumping.
5. Sample and report the water quality presently available in Reservoir Number 1. The parameters to be reported are detailed in Certificate of Approval to Operate No. 1642-356 Appendix A, Section 8.

6. The Company to develop a proposal for a monitoring program to determine the extent of contamination in the Gerald Lake basin. This proposal to be reviewed with the Mines Pollution Control Branch prior to implementation.

Contingency Plans

KLMC was requested to develop a contingency plan that would address the containment of contaminated waters on-site for the case of:

(a) failure of tailings road dyke; and

(b) failure of Reservoir Number 1.

Clean-up Plan

KLMC was requested to submit to the department a plan for the clean-up of the Gerald Lake basin. This report to be available to the Department by January 31, 1984.

It was noted that KLMC had agreed to initiate the following:

1. prepare and install culvert caps on the downstream end of the tailings road/Wolf Lake culverts. This installation to be considered a priority item;

2. the installation of a system to recover contaminated waters from the Gerald Lake basin. The recovered liquid to be returned to Reservoir Number 1 and the volume recovered reported to the Mines Pollution Control Branch;
3. to continue to lower the water levels in Reservoir Number 1; and
4. to complete the installation of a water level monitoring and alarm system for the reservoirs.

Representatives of the Atomic Energy Control Board, Environment Canada, Saskatchewan Labour attended the meeting between Mr. Hardy and KLMC officials and were in general agreement with the above instructions. The need to establish an operating level in Reservoir Number 1 was discussed and it was agreed that more expert advise would be required before the level could be stipulated. Sensors and alarm systems could then be tied to that elevation.

3.3 Progress

Saskatchewan Environment retained IEC Beak Consultants Limited, Mississauga, Ontario to provide advice on:

- the results of monitoring programs related to the spill;

- the fate and consequences of the spilled contaminants; and
- proposed remedial measures.

Key Lake Mining Corporation submitted and received approval for its monitoring program by January 15. In addition to the KLMC Monitoring Program, samples were also collected by Saskatchewan Environment to confirm KLMC's result. Sampling was completed by January 22 and most results were available from the laboratory by mid-February.

KLMC submitted a proposed plan for clean-up by January 31, 1984, which was made public. In addition:

- caps were installed on the culverts in the tailings management area road;
- 67,000 cubic metres of water were pumped to the mill from behind the Wolf Dyke by February 24, 1984;
- water levels in Reservoir Number 1 were lowered below elevation 537.5 m;
- alarms were installed and necessary computer programs written;
- the pipeline was moved from the Wolf Dyke and installed at Gerald Lake by March 2, 1984;
- repairs to Reservoir Number 2 were completed by March 12, 1984.

4. DISCUSSION

4.1 Cause of the Spill

The spill resulted because the company overtopped the lowest point of the two reservoirs not because of structural failure of a dyke. The cause was poor operation by the company (a good description of the mechanics of the failure is found in section 4.2 of the report by P. Machibroda Engineering Limited pages 14 and 15).

The design of Reservoirs Number 1 and 2 was such that each reservoir could be operated independently with a spillway between the two. The design maximum elevation for each reservoir was 537.5 m, the design height of the common spillway. The design top of the outside dykes was 539.0 m to provide a minimum freeboard of 1.5 m.

KLMC had been operating beyond the design maximum for over a month as observed and reported by staff of the Mines Pollution Control Branch on November 24 and December 14, 1983.

Water supply, mine pit dewatering, mill operations and waste treatment are a totally integrated system at the Key Lake Mine/Mill complex. If the mill is shut down for any reason, as it was prior to the spill, there is no means of treating contaminated water so it can be released to the environment. Inflows to the two reservoirs were allowed to continue until

they were overtopped. Co-ordinated management is required to ensure inputs from the mine pit and the tailings management area are balanced with other operating constraints. Water balance is a critical aspect of managing this operation if the environment is to be protected.

The most recent water balance proposals by Key Mining Corporation have only just been received and are currently under review by the Mines Pollution Control Branch. They will form the basis for discussions of the operating approval Saskatchewan Environment will issue before May 31, 1984.

It is worthy of mention in this report that P. Machibroda Engineering Limited found two discrepancies between the as constructed plans and actual conditions at Reservoirs Number 1 and 2. Both affected the amount of available freeboard. A survey subsequent to the spill revealed the spillway crest to be 538.2 (not 537.5) metres and the dyke in the area of the spill to be at elevation 538.8 (not 539.0) metres. Therefore the operating freeboard was 0.6 m not 1.5 metres.

The significance of these findings cannot be directly related to the overtopping. Investigations by Saskatchewan Environment staff did not reveal that company personnel had established a direct relationship between pumping rates and reservoir freeboard capacities. However, it is important to

note that it was necessary to replace defective liners prior to start-up. It would appear that these repair activities are responsible for the two changes in elevation that reduced freeboard capacity. The importance of post-repair surveys should be noted.

4.2 The Impact of the Spill

The environmental impact of the spill will be minimal because of a series of fortuitous circumstances. Levels of contamination in the ponds had not yet reached possible maximum levels. The smaller of the two reservoirs was overtopped first. The spill of contaminated water followed an overland route to nearby Gerald Lake. Most of the spill is still contained in the lower portions of this small but deep lake of 25 to 30 acres surface area. The lake is a ground water discharge area (into the lake). Overflow from the lake is to a muskeg area above a road. (Muskeg tends to filter out contaminants.) The road was suitably located to build a temporary dyke to stop migration of water from the area.

A detailed evaluation of the environmental impact and fate of the contaminants is contained in the report by IEC Beak Consultants Limited.

5. CLEAN-UP AND OTHER REQUIREMENTS

5.1 Clean-Up

5.1.1 Considerations

In order to prescribe clean-up requirements for KLMC it is necessary to establish over all objectives for the surrounding environment (i.e. Gerald Lake). Fortunately there exists a prescribed set of objectives, the Water Quality Objectives published by the Saskatchewan Water Pollution Control Branch in 1975. Maximum concentrations have been prescribed for numerous parameters including Radium 226. These objectives (Appendix A) are adequate to protect public health and preserve fish and wildlife and are therefore recommended as a guide to decision-making.

As indicated earlier one of the first considerations after the spill was the stability of the road (Wolf Dyke) to the Tailings Management Area where spilled water, or water displaced from Gerald Lake, was accumulating. KLMC constructed a pipe line to pump this water back for use of the mill. By February 24 the pump was turned off for lack of water. An estimated 67,000 cubic metres had been pumped by that date. The quality of the water probably met provincial surface water quality objectives but the need to remove the water by establishing a pumping

system required an early, rather arbitrary, decision on where to take the water. By using the water for mill processing KLMC was able to ensure any contaminated water that had escaped from Gerald Lake would receive treatment.

Other factors must receive attention in determining the final clean-up activities. A reference has been made to a water balance problem. The long-term integrity of the tailings mass in the Tailings Management Area (TMA) must be protected. The TMA was not designed to operate with large volumes of water in a static state, particularly in the winter months. The tailings are to be layered and surplus water removed. The under drain system could be damaged if excess water remains in the system by next freeze up.

A second area of concern is the level of water in the mine pits. The slope stability cannot be allowed to become a worker safety hazard. Also, if levels rise too high, pit water could contaminate the surrounding dewatering system so that even larger amounts of water require treatment before discharge to the environment.

A third area of concern in order to maintain the water balance is the ability of the effluent treatment

system in the mill to produce an effluent that can be released to the environment. KLMC has asked the Department to revise upward the emission level for ammonia until next fall. This matter is under review. Preliminary indications are that a higher emission standard can be permitted in the short-term providing KLMC can maintain pH levels within a certain range. A criteria document from Ontario is being used in this evaluation process.

The ammonia problem in the effluent arises for several reasons. There were sources in the vapour condensate and yellowcake precipitation works in the mill. Remedial work has now eliminated these sources. However there remain elevated levels in water throughout the system (i.e. the Tailings Management Area, Reservoir Number 1, etc.). It may be desirable to establish a higher effluent discharge limit for ammonia as an alternative to introducing extra amounts of fresh water for dilution purposes and thereby increase the water balance problem.

5.1.2 Recommended Clean-Up Strategy

The objectives for clean-up should be:

1. Return of Gerald Lake to a state that it meets Saskatchewan Surface Water Quality Objectives;
2. Protection of slope stability in the mine pits;
3. Elimination of surplus water from the Tailings Management Area before freeze up in the fall of 1984; and
4. To minimize the amount of fresh water contaminated by the remedial measures.

Key Lake Mining Corporation Limited should therefore:

1. Pump 100,000 cubic metres of water from Gerald Lake before spring break up and use the water in the mill. Report weekly on progress;
2. After the 100,000 cubic metres has been pumped leave the temporary pipeline in place until further directions are received from Saskatchewan Environment;
3. Repeat the Gerald Lake water quality monitoring program as soon as possible after spring break up.
4. Clean out the culverts in the road to the Tailings Management Area to ensure free passage of spring runoff from the muskeg area; and

5. Sample the flow from the muskeg on a daily basis and analyze for ammonia, arsenic, conductivity, lead, nickel, pH, Ra226, sulphates, and uranium.

5.1.3 Additional Requirements

The reports by P. Machibroda Engineering Limited and F. Clyde Lendrum Consulting Limited combined with the experiences of Saskatchewan Environment staff lead to additional proposals respecting the operation of the Key Lake Mine/Mill complex. While the January 5 and other spills may be attributed to the problems of bringing a large new operation into production, the department has to take into account Machibroda's opinion that other spills are inevitable. Therefore the Company must not only deal with the obvious problems but also be aware of and responsive to concerns raised periodically by Saskatchewan Environment staff.

Reservoirs Number 1 and 2

After Reservoir Number 2 is reconstructed, Key Lake Mining Corporation should be required to operate the two reservoirs with a minimum free board of 1.5 m at all times. The common spillway should be lowered to 537.5 m and the top of the dykes raised to 539.0 m. Both reservoirs should be equipped with a sound/visual

alarm system that is triggered when elevations in either reservoir reach 537.5 m. The indicators should permit checking at 537.5 and a lower elevation to ensure the system can be checked at regular intervals.

Since runoff from the mill terrace is to the reservoirs, they should be operated to accomodate a maximum summer rain event without exceeding 537.5 m.

P. Machibroda Enginnering Ltd. recommended protection of the dykes from erosion. High density polyethelene and other materials were suggested. They also proposed the need for a spill holding reservoir to compliment a contingency plan for a potential maximum size spill. KLMC should be required to respond to these proposals within a reasonable period.

Mill and Mill Terrace Area

As pointed out in the F. Clyde Lendrum Consulting Limited report some preventative measures are still necessary in the mill and terrace area. Detailed plans for the layout of the mill terrace area are required to ensure that runoff and spills can be captured and accommodated in the two reservoirs. The plans should consider below ground level trenches/

culverts and placement of elevated lips on sanitary sewer manholes. Only when these plans have been approved by Saskatchewan Environment should construction be undertaken. This activity should be timed to coincide with completion of fill, grading and paving at the grinding plant.

KLMC should install door sills to increase volumes within buildings where spills are expected to occur. A curb should be placed in the CCD corridor to protect the electrical room.

Environmental Reporting

Saskatchewan Environment believes that its concerns and reports may not always reach the appropriate/responsible person within KLMC. While the company has installed many excellent devices to minimize the impact on the environment and established a good environmental section, their success depends upon good operating procedures and communication.

KLMC should review its management structure to ensure environmental considerations receive a high priority in the operation of the mine mill complex.

Further, there is a need for KLMC to review and update its spill contingency plans which were submitted in late 1981.

6. PUBLIC INFORMATION

To inform the public about the spill and follow-up activities several media releases were issued by Saskatchewan Environment between January 6 and February 2, 1984 (Appendix B). Some difficulties were encountered because of a lack of precise data.

The amount of water spilled was first estimated at 75 000 m^3 based on the size of the affected reservoir. A second estimate of 100 438 m^3 was based upon a ground survey by KLMC on January 6. However, KLMC advised later that another survey had revealed an error in the first survey and the volume lost was now calculated to be:

67 662 m^3 Reservoir Number 2

19 668 m^3 Reservoir Number 1

87 330 m^3

This created some public confusion as the numbers had to be updated.

With respect to monitored data, the first Ra226 values were not known until 2115 hours on January 6. The KLMC lab on-site has an analyzer but it was out of service at the time. As a result samples had to be flown to Saskatoon for analyses at the Saskatchewan Research Council.

In order to provide an estimate of possible Ra226 in the first media release, original design submissions by KLMC were reviewed by the department. Those documents predicted Ra226 levels could rise as high as 150 bequerels per litre (Bq/L). It was decided to use that as an estimate in the media release.

The first monitored results of flow from Reservoir Number 2 were received in Regina at 2210 hours Saturday, January 6. A sample submitted by KLMC to the Saskatchewan Research Council had a reported value of approximately 17 Bq/L by the quick test. At 0835 hours, Monday morning the Saskatchewan Research Council provided a revised value of 19± Bq/L after a longer test. A value of 20 Bq/L was subsequently chosen for use in the January 9 release.

The department is of the opinion that the quality of reporting by the media was generally factual. There appeared to be some instances where the situation was over stated. However, given the number of calls and the time spent discussing the situation with the Head of the Waste Management Division, the department is of the opinion that a sincere effort was made by most to report the event in a factual way.

7. REGULATION AND INSPECTION OF THE KEY LAKE MINE/MILL COMPLEX

7.1 Provincial and Federal Roles

It is believed that some improvements can be made in the current regulatory process for uranium mines. The two most significant areas of concern are the dual responsibility of the federal and provincial governments and the lack of provincial regulations specific to the industry.

Natural resources were transferred to the province in the 1930's. However, the federal government declared the nuclear and uranium industries "to be for the general advantage of Canada" in 1946 under Section 92.10 (c) of the BNA Act. As a result water, land and minerals are under provincial jurisdiction but uranium mines, mills and employees are under federal law.

The Bayda Inquiry in 1979 recognized the problems of dual regulatory responsibility and recommended a "Committee consisting of federal and provincial authorities to identify all areas of uncertainty, confusion or dispute between the two levels of government in respect of the regulation of the nuclear industry (particularly mining and milling uranium)...". It was further suggested that agreements should be arrived at between the two levels of government and take the form of an accord "to remove areas of uncertainty and confusion...".

No such committee was ever structured nor has there been any clarification of roles. The Department has attempted several times over the last year to initiate discussions of responsibilities for uranium mining through Energy, Mines and Resources Canada without success. Since January 5 federal officials have indicated a willingness to have discussions at a senior officials level.

The Bayda Inquiry also recommended changes to the Saskatchewan's Pollution Prevention Regulations for the Mineral Industry, 1970. A new set of regulations specific to the uranium industry has been drafted with input from over 40 organizations, companies and agencies. Adoption of these regulations would help clarify what the province expects of uranium mining companies.

One could question what it is that makes uranium mines so different from the over 20 other mines in the province that the federal government has to become directly involved in regulating mining and milling. It is true that some radioactive substances are involved but most never leave the site. A current thrust by the federal government is to have low-level radioactive waste administered by the provinces. This requires establishment of expertise to handle this type of waste. By ensuring uranium mine wastes are clearly a provincial responsibility too, there could be opportunities

to build a better base of expertise in the province. As things now stand, resources are fragmented and diluted. Further, when mining ends the province is left with any problems.

A good case can be made for federal govenment involvement when there is yellowcake to be accounted for. As a material subject to international agreements, stringent safeguards are required. This could be achieved without involvement in the environmental aspects of uranium mining and milling.

It is recognized that not all provinces are in agreement on the approach to this issue. Arrangements should be flexible enough to allow those provinces that are willing, to assume clear control over uranium mines and mills.

7.2 Provincial Regulatory Program

7.2.1 Summary

The province's program to regulate the environmental aspects of the uranium industry is administered by the Mines Pollution Control Branch of Saskatchewan Environment. The program includes:

(a) A requirement for companies to obtain approval prior to construction of any waste treatment or handling facility. To date, KLMC have been

issued 14 separate approvals. A listing is attached as Appendix C.

(b) A requirement for companies to obtain an annual "approval to operate" and to meet the conditions of the approval.

(c) Regular monthly on-site inspections by Branch staff to ensure that regulations and "approval to operate" conditions are being met.

(d) Reviews of the monitoring data produced by the Branch and provided by the company to ensure that effluent limits are being met.

(e) Review of all reports submitted by the company.

(f) Follow-up by Branch staff on any area of concern.

7.2.2 Legislative Authority

The Branch uses The Water Resources Management (WRM) Act and regulations and The Air Pollution Control Act and regulations as the legislative authority for the program. For the KLMC site, Section 15 of The WRM Act is also used to authorize

the operation of the two major dewatering programs. These programs are required to lower the water table around the ore bodies to allow mining to take place.

Should the draft regulations be adopted they would not change the Department's approach to regulating the industry but would simplify the legal aspects and would provide provincial control over decommissioning of sites. The new regulations would also provide for the increased maximum penalties prescribed in The DOE Act of $100,000 compared to $5,000 in The Water Resources Management Act.

7.2.3 The Approvals Process

7.2.3.1 Approvals to Construct

As indicated above, 14 construction approvals have been issued to KLMC by Saskatchewan Environment.

Applications for approval to construct are generally accompanied by a design report, technical specifications and drawings. The branch compiles an initial review of the proposal and if sufficient information has been provided to allow a decision to be made an approval document is prepared

for review and approval by the Deputy Minister. Should the proposal not be suitable or should not enough information be available, the company is advised. Approvals can be issued containing conditions dealing with specific concerns or monitoring requirements.

Once the approval is issued, staff of the branch include the construction activity on their regular inspection. In the case of major construction projects, branch staff have been placed on-site to inspect the ongoing construction. For large projects the company is required to submit a report after completion of construction.

With respect to water storage Reservoirs Number 1 and 2, the application was was received by the Mines Pollution Control Branch in 1981. Additional details were received in Ma[illegible], 1982. The approval to construct was issued on May 4, 1982 (Appendix D). There was discussion in the application of maximum operating levels of elevation 537.5.

7.2.3.2 Approvals to Operate

The first approval to operate was issued to KLMC on June 30, 1983, to expire February 29, 1984 (Appendix E). This has been extended to May 31, 1984 to provide time to incorporate any changes required as a result of the spill.

The "approval to operate" contains nineteen conditions ranging from requirements to ensure that clean water is not contaminated, comprehensive air, water, ground water, sediment and aquatic biota monitoring programs and the reporting of the results, to the establishing of effluent limits for the operation.

The operating approval is the basis for a continuing dialogue between branch staff and company officials. As well, prior to the reissuance of the approval a meeting is held with the company for the specific purpose of reviewing the performance of the company over the previous year.

The discharges from the dewatering programs are authorized under The Water Resources Management Act and must meet the Saskatchewan Surface Water Quality Objectives at point of discharge.

7.2.4 Inspections

Staff of the Mines Pollution Control Branch conduct regular monthly inspections of each uranium operation. An inspection of the KLMC site would include:

(a) Sampling of mill effluent, dewatering effluents, receiving streams, and on occasion, sewage plant effluent.

(b) Inspection of the following areas:

- Tailings Management Area
- Gaertner Pit
- Deilman Dewatering System
- Ore, Cobble Ore and Special Waste Areas
- Crush-Grind Facility
- Water Storage Reservoirs
- Monitoring Ponds
- Mill Terrace Area
- Specific areas of concern or areas identified as concerns from previous inspection, or areas where other Saskatchewan Environment branches have requested an inspection (i.e. sewage plant)
- Spill Clean-up Areas
- The inspections include a photographic record.

(c) Discussion with KLMC officials on-site of any concerns or problem areas.

(d) Preparation of an inspection report (Appendix E).

(e) Follow-up with the Saskatoon office of KLMC of any concerns that were not handled on-site or to confirm any commitments made by KLMC on-site.

With respect to Reservoirs Number 1 and 2, the inspection reports referenced the levels of water on April 26, May 17, June 8, July 14 ("reservoir number 2 was full at the time of inspection"), August 23, September 19, October 5 ("Reservoir number 1 was full"), November 24 ("both reservoirs were near full [approximately 0.5 metres freeboard], with very little capacity remaining"), December 14 (Reservoir Number 1 and Reservoir Number 2 water level freeboard was estimated to be approximately one metre").

7.2.5 Data Reporting

As indicated above, the operating approval requires the company to submit on a regular basis all of the results of the monitoring conducted under the approval. These submissions are in the form of a monthly report and an annual report.

The monthly report is required within six weeks of the end of the month being reported and requires explanations of any unusual results or limit excursions.

The annual report for 1983 is required by April 30, 1984, and must include an interpretation of the data, a review of the data compared to effluent limits, documentation of any past or proposed operational changes or changes in the treatment systems. The report also must include the results of the hydrogeological monitoring program and survey measurements for the surface movement monuments located at the Tailings Management Area.

All of the surface water quality data reported by the company and collected by the branch is placed into a storage and retrieval system called "Esquadat". This computerized system allows for rapid retrieval of information and has the capability for reporting in a variety of formats including graphically.

8. CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the January 5, 1984 spill was the result of poor operation by the Key Lake Mining Corporation. The environmental impact will be minimal after clean-up. There are improvements that can be made in the regulatory process but it is also necessary to prepare for possible future mishaps.

To achieve a satisfactory clean-up of the spill it is recommended that:

1. Key Lake Mining Corporation (KLMC) pump 100,000 cubic metres of water from Gerald Lake before spring break up and that the water be used in the mill. The intake should be positioned at the 7 to 8 metre depth. KLMC should be required to report progress weekly and carry out a sampling program at stations 4, 6 and 10 at surface, mid-depth and the bottom after pumping is completed.

2. After the pumping is completed KLMC should leave the temporary pipeline in place until further instructions are received from Saskatchewan Environment.

3. KLMC should repeat the Gerald Lake water quality monitoring program as soon as possible after spring break up and report to the department by July 1, 1984.

4. KLMC should clear the culverts in the road to the Tailings Management Area to allow spring runoff from the muskeg to pass downstream. KLMC should sample that runoff on a daily basis and analyze for ammonia, arsenic, conductivity, lead, nickel, radium 226, sulphate and uranium. The results of the analyses should be reported to Saskatchewan Environment on a daily basis.

To prevent a similar occurrence it is recommended KLMC:

1. Lower the spillway between Reservoirs Number 1 and 2 to elevations 537.5 m and ensure the outer dyke is at 539.0 m;

2. Operate both reservoirs below elevation 537.5 m and with sufficient capacity to accommodate maximum possible runoff from the mill terrace area under a storm event;

3. Install sound/visual alarms at elevation 537.5 and at a lower level so these alarms can be checked on a daily basis;

4. Submit to Saskatchewan Environment no later than May 31, 1984 a response to the proposals by P. Machibroda Engineering Limited to protect the

dykes around Reservoirs Number 1 and 2 and to construct a spill holding reservoir to accommodate the maximum possible spill in that area.

To ensure operation of the mill complex does not pose a threat to the environment it is recommended that KLMC:

1. Install door sills to increase volumes that can be contained within the mill buildings this summer;

2. Install a curb in the CCD corridor to protect the electrical room this summer;

3. Submit no later than April 30, 1984 for the approval of Saskatchewan Environment, detailed plans for ensuring runoff from spills from the mill terrace will report to Reservoirs Number 1 and 2.

To clarify for the Company, its managers and operating personnel KLMC's responsibilities for environmental protection, it is recommended;

1. That KLMC review its management structure to ensure environmental concerns receive prompt and effective attention;

2. That the Province of Saskatchewan make every effort to negotiate with the federal government a clear understanding of the roles and responsibilities of the two senior levels of government in the regulation of the environmental aspects of uranium mining and milling.

3. That the province enact the proposed regulations specific to the uranium industry at the earliest possible date.

To ensure prompt and effective response to all spills, it is recommended that KLMC be required to submit to Saskatchewan Environment no later than April 30, 1984 a revised spill contingency plan together with details of its staff training plans to ensure the appropriate response to such events.

To upgrade provincial surveillance activities at uranium mines, it is recommended that additional staff be made available to the Mines Pollution Control Branch. This will permit closer surveillance during construction and start-up. Further, it will ensure improved reviews of construction plans, monitored data and company report.

APPENDIX A

APPENDIX A

Table 1

SURFACE WATER QUALITY OBJECTIVES

These objectives have been prepared in co-operation with the Provinces of Alberta and Manitoba and represent water quality suitable for most uses either through direct use or prepared for use by an economically practical degree of treatment.

Parameter	Objectives
1. Bacteriology (Coliform Group)	(a) In waters to be withdrawn for treatment and distribution as a potable supply or used for outdoor recreation other than direct contact, at least 90 per cent of the samples (not less than five samples in any consecutive 30-day period) should have a total coliform density of less than 5,000 per 100 ml and a fecal coliform density of less than 1,000 per 100 ml. (The Maximum Permissible Limit of total coliform organisms in a single sample shall be determined by the Department based on the type and degree of pollution and other local conditions existing within the watershed.) (b) In waters used for direct contact recreation or vegetable crop irrigation the geometric mean of not less than five samples taken over not more than a 30-day period should not exceed 1,000 per 100 ml total coliforms, nor 200 per 100 ml fecal coliforms, nor exceed these numbers in more than 20 per cent of the samples examined during any month, nor exceed 2,400 per 100 ml total coliforms on any day.
2. Dissolved Oxygen	A minimum of five mg/l at any time.
3. Biochemical Oxygen Demand	Dependent on the assimilative capacity of the receiving water. The BOD must not exceed a limit which would create a dissolved oxygen content of less than five mg/l.
4. Suspended Solids	Not to be increased by more than 10 mg/l over background value.
5. pH	To be in the range of 6.5 to 8.5 pH units but not altered by more than 0.5 pH units from background value.
6. Temperature	Not to be increased by more than 3°C above ambient water temperature.
7. Odour	The cold (20°C) threshold odour number not to exceed eight.
8. Colour (Apparent)	Not to be increased more than 30 colour units above natural value.
9. Turbidity	Not to exceed more than 5% turbidity units over natural turbidity.

10. Organic Chemicals

Constituent	Maximum Concentration (mg/l)
Carbon Chloroform Extract (CCE) (includes Carbon Alcohol Extract)	0.2
Methyl Mercaptan	0.05
Methylene Blue Active Substances	0.5
Oil and Grease	— substantially absent no irridescent sheen
Phenolics	0.005
Resin Acids	0.1

Pesticides — To provide reasonably safe concentrations of these materials in receiving waters an application shall not exceed 1/100 of the 48-hour TL_m. Consideration must also be given to sublethal effects such as taste and odour generation.

11 Inorganic Chemicals

Constituent	Maximum Concentration (mg/l)
Boron	0.5
Copper	0.02
Fluoride	1.5
Iron	0.3
Manganese	0.05
*Nitrogen (Total Inorganic and Organic)	1.0
*Phosphorus as PO_4 (Total Inorganic and Organic)	0.15 (0.05 as P)
Sodium (as per cent of cations)	between 30 and 75
Sulphide	0.05
Zinc	0.05

* These objectives are presently under study and may require adjusting according to naturally occurring concentrations or conditions.

NOTE: The predominant cations of sodium, calcium and magnesium and anions of sulphate, chloride and bicarbonate are too variable in the natural water quality state to attempt to define limits. Nevertheless, in order to prevent impairment of water quality, where effluents containing these ions are discharged to a water body the permissible concentration will be determined by the Department in accordance with existing quality and use.

12. Toxic Chemicals

Constituent	Maximum Concentration (mg/l)
Arsenic	0.01
Barium	1.0
Cadmium	0.01
Chromium	0.05
Cyanide	0.01
Lead	0.05
Mercury	0.0001
Selenium	0.01
Silver	0.05

13. Radioactivity — Gross Beta not to exceed 1,000 pCi/l.
Radium 226 not to exceed three pCi/l. (0.1 Bq/L)
Strontium 90 not to exceed 10 pCi/l.

14. Unspecified Substances — Substances not specified herein should not exceed values which are considered to be deleterious for the most critical use as established by the Department.

NOTE: Unless specified, parameter concentrations refer to "total" measurements.

* Becquerels/Litre

APPENDIX B

APPENDIX B

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3
(306) 565-6281

News Release

IMMEDIATE RELEASE
Jan. 6, 1984

Saskatchewan

Environment 84-010

MAJOR SPILL AT KEY LAKE

Saskatchewan Environment today announced a major spill of water stored for use in the mill process occurred Thursday at the Key Lake Uranium Mine in Northern Saskatchewan.

The spill was reported immediately by Key Lake mine officials to Saskatchewan Environment. Up to 75,000 cubic metres, the equivalent of about 16.5 million gallons, spilled from a holding reservoir at the mine site as the result of a dike failure.

Water flowed into a low lying area adjacent to the mill site. Diking work was carried out by the company to contain the spill at that point.

The water is contaminated with radium 226 at an estimated level of 150 becquerels per litre. That level exceeds the accepted level of discharge into the environment of 0.37 becquerels per litre.

The spill does not represent a significantly increased hazard to workers on the site.

....2

Saskatchewan Environment officials are on the site and have begun a full investigation. Additional information will be provided by Saskatchewan Environment as it becomes available.

-30-

For further information, contact:

Dave Clark
Saskatchewan Environment
565-6259
or
337-3500

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3

(306) 565-6281

News Release

IMMEDIATE RELEASE
Jan. 9, 1984

Saskatchewan

Environment 84-015

MINOR SPILL AT KEY LAKE

Saskatchewan Environment reported today another spill, this one of a minor nature, has occurred at the Key Lake uranium mine in northern Saskatchewan. The spill material was immediately contained, recovered and placed in the special waste storage area at the site.

The spill took place on Saturday when 450 litres of solution used in the milling process overflowed from a tank within the mill.

No significant increase in hazard to the environment is expected.

This latest incident occurred during an attempt to reduce the level of water in reservoir #1 and follows a major spill on Thursday, from an adjacent holding reservoir.

In a new assessment of the Thursday spill, Saskatchewan Environment has found the volume of water which escaped is higher than originally estimated. It is now at 100,000 cubic metres or 100 million litres. However, the level of radium 226 in the contaminated water is much lower than the 150 becquerels per litre first estimated. The contamination level is now put at 20 becquerels per litre.

Saskatchewan Environment has officials on site and is investigating both spills.

-30-

....2

For further information, contact:

D.J. Clark
Head, Waste Management Division
Land Protection Branch
Saskatchewan Environment
5th Floor, 1855 Victoria Avenue
Regina, Saskatchewan
S4P 3V5

Phone: 565-6259

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3

(306) 565-6281

News Release

IMMEDIATE RELEASE
Jan. 10, 1984

Saskatchewan

Environment 84-020

SURVEILLANCE OF SPILL CONTAINMENT WORK CONTINUING

Saskatchewan Environment has announced that surveillance of spill containment work at the Key Lake uranium mine is continuing and that an independent consultant has been brought on site to investigate and advise on diking activities.

It also reported water is building up under the ice behind the temporary containment dike. To relieve that situation, the mining company is putting in a pipeline to pump the water back to its No. 1 reservoir. Water in that reservoir is currently being drawn down as part of the milling process.

Environment Minister Neal Hardy plans to visit the mine Wednesday. Department personnel remain on site.

Temperatures in the minus 40 to 45 degree Celsius range continued to make working conditions severe.

-30-

For further information, contact:

D.J. Clark
Head, Waste Management Division
Land Protection Branch
Saskatchewan Environment
5th Floor, 1855 Victoria Avenue
Regina, Saskatchewan
S4P 3V5

Phone: 565-6259

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3

(306) 565-6281

News Release

IMMEDIATE RELEASE
Jan. 11, 1984

Saskatchewan

Environment 84-024

NO EVIDENCE OF SEEPAGE IN AREA OF DIKE

Saskatchewan Environment announced today there is no evidence of seepage in the area of the dikes at the Key Lake uranium mine in northern Saskatchewan around a major spill of radium contaminated water which occurred last Thursday.

The department is continuing surveillance of spill containment work and expects water levels in front of the dikes will be reduced by pumping back to reservoir #1, later today.

Environment Minister Neal Hardy, together with department investigators, is at the mine today, meeting with officials of Key Lake Mining Corporation.

Temperatures remain in the minus 40 to 45 degree Celsius range, making working conditions severe.

Saskatchewan Environment also commented today on so-called discrepancies concerning the volume of the spill and the level of radium in the contaminated water.

In the first report released on Friday, Jan. 6, 1984, estimated levels of radium 226 were set at 150 becquerels per litre, based on the company's estimate of maximum design levels. As a result of the department's testing, the actual levels have been revised downward to 20 becquerels per litre.

....2

A more accurate estimate has also been made of the amount of water spilled. Again, based on on-site observations by Environment investigators, the amount was estimated on Friday to be 75,000 cubic metres. Actual surveys undertaken by the mine have shown that approximately 70,000 cubic metres were lost from reservoir #2. The survey also revealed that an additional 30,000 cubic metres were lost out of reservoir #1, via a spillway connecting the two reservoirs.

Environment officials have also noted that several comments attributed to them have been misinterpreted. While the department is greatly concerned about potential environmental impacts of the spill, phrases such as "irreversible" or "catastrophic consequences" with respect to the spill are not appropriate and were not used by department spokesmen.

The department is confident the spill has been contained and will ensure all necessary cleanup measures are undertaken.

-30-

For further information, contact:

D.J. Clark
Head, Waste Management Division
Land Protection Branch
Saskatchewan Environment
5th Floor, 1855 Victoria Avenue
Regina, Saskatchewan
S4P 3V5

Phone: 565-6259

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3

(306) 565-8281

News Release

IMMEDIATE RELEASE
Jan. 12, 1984

Saskatchewan

Environment 84-028

HARDY FEELS SPILL SITUATION UNDER CONTROL

Environment Minister Neal Hardy inspected the Key Lake mine site Wednesday and said he feels the situation is under control.

In a meeting with mine officials, Hardy set out monitoring requirements and established a deadline date of Jan. 31 for receipt of cleanup proposals for approval by Saskatchewan Environment.

Officials from the federal Atomic Energy Control Board, Environment Canada and Occupational Health and Safety with Saskatchewan Labor were in attendance at the meeting and agreed with the requirements established.

Saskatchewan Environment announced that Key Lake Mining Corporation has filed its preliminary report concerning the Jan. 5 spill of 100,000 cubic metres of contaminated water. This report is in compliance with the Spill Control Regulations under the Department of the Environment Act.

A preliminary report from the geotechnical specialist concerning the structural stability of the containment system and reservoir #1 have also been received by the department with the findings of the final report expected by Jan. 24, 1984. All final reports will be made public.

....2

Copies of the 1983 inspection reports prepared by staff of the Mines Pollution Control Branch have been forwarded to Opposition Leader Allan Blakeney as requested Jan. 10. The December inspection report will be forwarded by courier from the department's Prince Albert office Monday.

The department noted that all spill reports are routinely kept on file in the department's library.

-30-

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3
(306) 565-6281

News Release

IMMEDIATE RELEASE
Jan. 13, 1984

Saskatchewan

Environment 84-034

PRELIMINARY SPILL REPORT RELEASED

Environment Minister Neal Hardy today released the preliminary report by Key Lake Mining Corporation on the Jan. 5 spill of an estimated 100 million litres of contaminated mill water.

The report is a requirement of the Spill Control Regulations.

The report provides a chronology of events leading up to the spill and actions taken by the company to contain the spill on site.

Also in the report are some preliminary monitored results and calculations of the volumes discharged.

The department also clarified information on the total number of spills at the mine-mill complex this fiscal year. Thursday, officials had erroneously reported that a total of 16 spills had been reported by the company. A review of departmental records revealed a total of 15 spills reported between April 1, 1983 and today.

There were eight spills of radioactive substances and seven spills of petroleum products (see attached table).

The company has advised that work to clean up the the breach in the reservoir #2 dike has started with a view to repairing that reservoir at the earliest possible date. It will be some time before a decision on the timing of the repairs can be made.

....2

SPILLS AT KEY LAKE URANIUM MINE - Radioactive

Date	Quantity	Material
83-08-03	40,000 litres	Process water
83-12-09	4,550 litres	Clarifier solution
83-12-23	1,125 litres	Pregnant uranium solution
83-12-24	1,350 litres	Pregnant uranium solution
84-01-01	100,000 litres	Uranium backwash solution
84-01-04	450 litres	Contaminated water
84-01-05	100 million litres	Mill water
84-01-07	450 litres	Pregnant uranium solution

Total: 100,147,925 litres; 8 spills

Non-Radioactive

83-09-09	1,136 litres	Diesel oil
83-09-14	4,500 litres	Diesel oil
83-09-18	450 litres	Diesel oil
83-10-07	600 litres	Diesel oil
83-10-08	6,000 litres	Diesel oil
83-10-30	500 litres	Diesel oil
83-11-11	50 litres	Diesel oil
	50 litres	Lube oil

Total: 13,286 litres; 7 spills

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3
(306) 565-6281

News Release

IMMEDIATE RELEASE
Jan. 16, 1984

Saskatchewan

Environment 84-037

SEWAGE SPILL AT KEY LAKE

A spill of sewage occurred at the Key Lake minesite Sunday afternoon at approximately 3 p.m.

Saskatchewan Environment staff were at the scene by 3:15 p.m.

A manhole in the sewer line from the mill to the domestic sewage treatment plant overflowed, releasing an estimated 150 to 200 gallons of sewage.

The spill was contained immediately. Liquids were collected and hauled to the tailings management area. Contaminated soil and snow was hauled to a special waste storage area.

The department was concerned that sewage might be contaminated with radium 226 from the mill and requested that the company carry out an analysis overnight.

The department was also concerned with the possible cause of the overflow and directed that Key Lake Mining Corporation personnel conduct an immediate investigation into the cause and find ways of preventing further releases from the mill area.

By 1:30 a.m. Monday morning a plug had been placed in the sewage flow line.

....2

Investigations into the cause continued throughout the night and were ongoing.

Analytical results received Monday revealed radium 226 levels of 23.8 becquerels per litre in the spilled sewage.

Late Saturday night Key Lake Mining Corporation completed the design of its intensive monitoring program to determine the full extent of contamination in the Gerald Lakecatchment basin. The plan was approved by Saskatchewan Environment staff onsite and sample gathering started Sunday.

It is expected that the sample collection phase will be completed by Tuesday.

-30-

For further information, contact

Dave Clark
Saskatchewan Environment
Regina

Phone 565-6259

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3
(306) 565-6281

News Release

IMMEDIATE RELEASE
Jan, 17, 1984

Saskatchewan

Environment 84-040

NO SOURCE FOUND YET

Saskatchewan Environment reported today that Key Lake Mining Corporation has not determined the source of Sunday's contamination of the minesite's sewage system as of 8:30 a.m. Tuesday.

Company efforts, using tracers, are continuing. Company and environment personnel are also continuing their intensive sampling program in the Gerald Lake catchment basin.

The department also issued a correction to information appended to a January 13 news release. The department had inadvertently reported that the August 1983 spill of radioactive process water amounted to 40,000 litres. In fact the total should have read 400,000 litres as shown on the public spill report form.

The error arose in transposing information from a computer printout to a typewritten table.

-30-

Government of Saskatchewan
Information Services

Legislative Building
Regina, Canada
S4S 0B3
(306) 565-6281

News Release

IMMEDIATE RELEASE
Feb. 2, 1984

Saskatchewan

Environment - 84-093

KEY LAKE REPORT RELEASED

Environment Minister Neal Hardy today released proposals by the Key Lake Mining Corporation to cleanup of the Jan. 5 spill of contaminated process water.

The report was received Wednesday and under study by department officials.

The department has already agreed to a proposal to pump water contained behind a temporary dike for use in the mill.

The department expects it will take at least two weeks to reply to the proposals. Results of the sampling program conducted by the department will not be available from the laboratory for another 10 to 12 days.

Hardy said it is necessary to review all of the analytical results before final instructions on the cleanup can be issued.

-30-

For further information, contact

Dave Clark
Waste Management Division
Land Protection Branch
Regina

Phone 565-6259

APPENDIX C

APPENDIX C

KLMC APPROVALS TO CONSTRUCT

1. Signed September 30, 1983 - #5973

   - Ground water collection and handling (Phase 1) of Deilmann System.

2. Signed November 29, 1982 - #5613

   - Feed utilidor and waste utilidor systems.

3. Signed August 25, 1982 - #5543

   - Connecting up the sewage collection system of the permanent camp site with existing facilities.

4. Signed August 25, 1982 - #5542

   - Connecting up the water discharge system of the permanent camp with the existing facilities.

5. Signed August 12, 1982 - #5527

   - Industrial wastewater line installation for feed water to the crush/grind area from the Gaertner Pit area.

6. Signed June 9, 1982 - #5429

   - Bulk neutralization and radium removal facilities.

7. Signed May 4, 1982 - #5439

   - Water storage reservoirs, monitoring ponds, ore-cobble ore and special waste storage areas.

8. Signed May 3, 1983 - #5351

   - Sewage collection system at permanent camp.

9. Signed May 3, 1982 - #5350

   - Water discharge system at permanent camp.

10. Signed November 16, 1981 - #5204

    - Tailings management facilities including:
      - underseal
      - under drainage
      - supernatant collection
      - embankments, etc.

11. Signed September 4, 1981 - #5103

    - Wells, pumps, water treatment plant and two storage tanks for domestic water.

12. Signed September 4, 1981 - #5102

    - Package sewage treatment plant.

13. Signed August 21, 1980 - #4624

    - Water discharge system for temporary camp.

14. Signed August 21, 1980 - #4625

    - Sewage collection system for temporary camp.

APPENDIX D

APPENDIX D

Province of Saskatchewan

DEPARTMENT OF THE ENVIRONMENT

Certificate No. 5349

CERTIFICATE OF APPROVAL TO CONSTRUCT

Issued Under the Authority of The Water Resources Management Act, 1972

Approval is hereby granted to construct industrial wastewater handling works as designated below for the uranium mining and milling operation of Key Lake Mining Corporation in accordance with the plans and specifications submitted to the department

Construction hereby authorized:

Facilities for the collection, handling and storage of industrial wastewaters from the uranium mining and milling operation of Key Lake Mining Corporation located near Key Lake in the Province of Saskatchewan at approximate UTM Grid Zone 13/6340000N/0457000E.

A. The contaminated water storage reservoirs; monitoring ponds; ore, cobble ore and special waste storage areas hereby approved are those constructed in accordance with the following documents submitted by the Key Lake Mining Corporation:

   1. "Final Site Application" dated September 11, 1979.

   2. Amendment No. 4, to the "Final Site Application", "Process Description, Site Layouts and Plans, Flow Sheets and Auxiliary Mill Facilities", dated July, 1981.

   3. Amendment No. 5, to the "Final Site Application", "Construction Details on Contaminated Water Storage Reservoirs, Monitoring Ponds, Ore and Special Waste Storage and Design Report on Contaminated Water System", dated February, 1982.

B. The Water Storage Reservoirs hereby approved include:

   1. Two reservoirs with capacities of 233,000 cubic metres and 117,000 cubic metres respectively, located immediately south of the mill site.

..... continued on p. 2

Dated at Regina, Saskatchewan, this 4th day of May A.D. 1982

Approved

Deputy Minister
Department of the Environment

CERTIFIED
TRUE COPY OF ORIGINAL

Department of the Environment

WPC-2 MAY. 1973

2. An underseal system of till-bentonite, moisture conditioned and compacted, with a minimum thickness of 200 mm.

3. A filter blanket of 500 mm thickness constructed with outwash sand complete with drainage pipe draining to separate sumps for each reservoir.

4. Embankments constructed of selected compacted till.

5. A synthetic liner of 45 mil thickness Hypalon or equivalent.

6. Associated inlet and outlet structures, manholes, piping, pumps, valves and sumps.

7. Instrumentation for monitoring the performance of the system including the underdrainage collection system and five (5) piezometers.

C. The Monitoring Ponds hereby approved include:

1. Five (5) ponds with capacities of 5200 cubic metres each, located immediately west of the mill site area.

2. Embankments constructed of selected till compacted to 100% standard proctor density.

3. Synthetic liners of 45 mil thickness Hyaplon or equivalent.

4. Associated piping, pumping facilities, valves, level control systems and inlet and outlet structures.

D. The Ore, Cobble Ore and Special Waste Storage Facilities hereby approved include:

An ore and cobble ore storage area of 7.6 hectares located north of the crushing and grinding facility and a special waste storage area of 2.0 hectares located southeast of the Gaertner open pit. The storage areas will be leveled and graded and will each be complete with a till-bentonite underseal of no less than 200 mm thickness; a 1.0 metre thick filter blanket of selected outwash sand with a drainage pipe system; a diversion system to divert uncontaminated runoff waters away from the facility; a compacted fill confining bund; and associated catch basins, sumps, pumping systems, piping, manholes, etc. to collect and handle all runoff and seepage from the storage areas.

E. After completion of construction of the water storage reservoirs, the monitoring ponds and the ore, cobble ore and special waste storage areas, Key Lake Mining Corporation shall submit to the Saskatchewan Department of the Environment a detailed report on the construction, a description of the as-built condition of the facilities, and a summary of the results of the quality control programs.

F. Approval to operate the industrial works, the construction of which is hereby approved, must be obtained from the Saskatchewan Department of the Environment prior to commencement of operation of the works.

CERTIFIED
TRUE COPY OF ORIGINAL

Department of the Environment

Key Lake Mining Corporation
22 [illegible]URTH AVENUE SOUTH, SASKATOON, SASKATCHEWAN S7K 4K3
TEL.: (306) 665-7000
TELEX: 074-2850

U 4-8-7

March 23, 1982

ATOMIC ENERGY CONTROL BOARD
P.O. Box 1046
OTTAWA, Ontario
K1P 5S9

ATTENTION: MR. W. WHITEHEAD

SUBJECT: YOUR TELEX NO. 0742850, FILE NO. 22-K-24-0
JANUARY 27, 1982

Dear Sir:

In response to item 2 of the above mentioned telex, we are pleased to enclose an Amendment #5 to our Final Site Application for your approval.

Amendment #5 includes the following sections related to waste management aspects of the Key Lake Project.

Section 1:	Design Details, Plans and Specifications for Contaminated Water Storage Reservoirs
Section 2:	Design Details, Plans and Specifications for Monitoring Ponds
Section 3:	Design Details, Plans and Specifications for Storage of Ore, Cobble Ore and Special Waste
Section 4:	Design Report on Contaminated Water System

It is KLMC's intention to provide detailed procedures to operate and monitor the above mentioned facilities after having received your approval for construction, which herewith is applied for.

Should there be any additional information or clarification required, please contact the undersigned.

Sincerely yours,

KEY LAKE MINING CORPORATION

J. ANDERSON
General Manager

JA:WU:jamcs

Attachment 6 copies of Amendment #5.

COPIES OF AMENDMENT #5 WILL BE FORWARDED TO THE FOLLOWING AGENCIES AND COMPANIES:

1 copy to:	Saskatchewan Department of Labour, Regina
1 copy to:	Environment Canada, Regina
1 copy to:	Environmental Protection Service, Edmonton
1 copy to:	Department of Northern Saskatchewan, Prince Albert
1 copy to:	Labour Canada, Winnipeg
✓ copy to:	Saskatchewan Environment, Prince Albert

Key Lake Mining Corporation

229C Fourth Avenue South, Saskatoon, Saskatchewan, Canada S7K 4K3. Tel (306) 665-7000. Telex No. 074-2850.

April 22, 1982

SASKATCHEWAN ENVIRONMENT
12th Floor, 800 Central Avenue,
P.O. Box 3003,
PRINCE ALBERT, Saskatchewan

ATTENTION: MR. R. R. SENTIS

SUBJECT: ATTACHMENT TO AMENDMENT #5
TO OUR FINAL SITE APPLICATION

Dear Sir:

We are pleased to enclose the attachment "Waste Management Facilities - Site Inspection Manual, Volume I" to Amendment #5 of our Final Site Application for your approval.

Amendment #5 was forwarded to you on March 23, 1982.

We will not sent Volume II as this contains only specifications, which were forwarded to you as part of Amendment #5.

Should there be any additional information or clarification required, please contact us.

Yours truly,

KEY LAKE MINING CORPORATION

DR. F. JANTZON
Executive Vice President

FR:BR:jamcs

Enclosure - 1 copy of Volume I

KLE-313

4-84

Key Lake Mining Corporation

229C 11TH AVENUE SOUTH, SASKATOON, SASK. S7K 4K3

TEL: (306) 665-7000

TELEX: 074-2850

TRANSMITTAL No. S 0846

DATE March 22, 1982

TO SASKATCHEWAN ENVIRONMENT PROJECT NO.

ADDRESS 12th Floor, 800 Central Avenue, P.O. Box 3003, PRINCE ALBERT, Saskatchewan

ATTENTION MR. R. R. SENTIS CARRIER

QUANTITY	DESCRIPTION OF MATERIAL	K.L.M. NUMBER (if applicable)
	Please find enclosed one copy of the following:	
	AMENDMENT #5 - CONSTRUCTION DETAILS ON CONTAMINATED WATER STORAGE RESERVOIRS MONITORING PONDS, ORE AND SPECIAL WASTE STORAGE AND DESIGN REPORT ON CONTAMINATED WATER SYSTEM.	

RECEIVED BY DATE

WHITE — Signed by receiver and returned to onginator
YELLOW — Retained by Receiver
PINK — Retained by Onginator
GOLD — Accounting

Area ... of

1. DESIGN DETAILS, PLANS AND SPECIFICATIONS FOR CONTAMINATED WATER STORAGE RESERVOIRS

REFERENCE DRAWINGS IN THE APPENDIX:

Drawing Title	Drawing Number
Mine Mill Layout	260-MG-001, A
Setting Out Details	2138-652-4201, 7
General Arrangement	2138-652-4202, 6
Excavation Details	2138-652-4203, 6
Plan on Filter Blanket and Underseal	2138-652-4204, 6
Sections	2138-652-4205, 6
Pipework General Arrangments and Sections	2138-652-4207, 8
Primary Sump Location Plan and Concrete Outlines	2138-652-4208, 6
Primary Sump Reinforcing Details	2138-652-4210, 5
Details of Low Level Inlets and Line Installation	2138-652-4211, 6
Details of Piezometer Installations	2138-652-4213, 5

1.1 GENERAL DESCRIPTION

The storage reservoirs for contaminated water covering a total area of about 6 ha are located adjacent to the west side of the mill site terrace. The primary purposes of the reservoirs are:

(a) to store all contaminated water generated by project facilities prior to mill operation,

(b) to serve as a buffer between continuous consumption and treatment of contaminated water during mill operation and discontinuous generation of contaminated water,

(c) to allow for temporary storage of contaminated water during extreme run-off events.

There will be a total of two storage reservoirs for contaminated water separated by lined earth embankments.

Reservoir #1 is located to the south and larger than reservoir #2 (see Drawing No. 260-MG-001). Both reservoirs are designed in the same manner and will be constructed in a cut-and-fill operation using mostly local till material. All earth embankments will be compacted to 95% relative density or more.

Construction materials, construction procedures and quality control will be essentially the same as described in reference reports (a) and (b) concerning the tailings storage facility, the only exception being a synthetic membrane exclusively used at the water storage reservoirs.

The purpose of this liner is to confine the contaminated water to the maximum extent possible. The material applied, 45 mil Hypalon, is generally attributed a permeability of about 10^{-13} m/s which means that the lined reservoirs can be considered water tight.

Hypalon has a good industrial track record and is generally accepted as a temporary sealant in the uranium industry.

The liner is bedded on a layer of compacted clean sand which is designed to form an integral part of a leak detection system. Drainage pipes are incorporated into the sandlayer to collect any leakage, should it ever occur, and to convey the liquid to a central sump. A low permeability till-bentonite layer below the sandlayer is designed to assist in the collection of seepage.

It should be noted that the assembly of sandlayer, drainage pipes and till-bentonite layer is arranged to act as a leak detection system by which already minor leaks can be detected. Reservoirs #1 and #2 have separate drainage pipe systems to facilitate the location of any unforeseen leak.

In addition to this leak detection system a total of five monitoring piezometers will be installed. Filtered sections will be installed above and below the till-bentonite layer (Drawing No. 2138-652-4213).

Reservoirs #1 and #2 have separated inlets and outlets. Reservoir #1 is filled through a fibreglass composite pipe of 375 mm nominal diameter. Reservoir #2 is filled through an epoxy coal tar lined steel pipe of 900 mm nominal diameter. Both reservoirs are drained by separate fibreglass composite pipes of 300 mm nominal diameters. The invert elevation of these pipes is about 1.2 m above the sloped bottom reservoir, so that solids are retained from the piping system, should there ever be a build up in the reservoirs. Both pipes discharge into a central 'dry' sump, which means that in-line pumps will be installed to transfer the water from the reservoirs to the sites of consumption or treatment.

Details on the pumpstation and pertinent piping do not form part of this report but will be made available as soon as possible.

The crest of the embankment between the two reservoirs declines over a section of about 45 m to allow for smooth overflow from one reservoir into the other should any unforeseen excessive inflow into one of the reservoirs ever occur.

A safety perimeter bund was incorporated into the design of the embankment crests which will protect against accidents and damage to the liner.

Run-off is diverted by means of ditches and culverts to maintain the structural integrity of the embankments.

1.2 METHOD OF OPERATION

Reservoirs #1 and #2 are designed to receive influents from different sources as outlined below:

Reservoir #1	Reservoir #2
Seepage from Ore, Cobble Ore and Special Waste Stockpile	Supernatant Recovery from Tailings
Run-off from Crushing & Grinding Area	Seepage Recovery from Tailings
Seepage and Run-off from Open Pits	Run-off from Mill Site
Floor Drainage and Lab Waste	

Most water discharged into Reservoir #1 is collected at mining facilities about 1.5 to 2.0 km away from the reservoir. This water is collected at a central sump located in the Crushing and Grinding area and pumped through a contaminated water line to the mill site. The contaminated water line will be confined in a concrete utilidor box. At the mill site this pipe will discharge into a buried fibre-glass composite pipe with continuous gradient to Reservoir #1. Drain pipes from the Neutralization Building and the Laboratories will also be connected to the gravity section of the contaminated water line. The amount of liquid lab waste and drainage is considered negligible in comparison with the volume derived from the mining facilities.

Return water from the tailings storage area is conveyed in a similar manner to Reservoir #2 as is done with contaminated water from the mine facilities.

Further details on the pumpstations and utilidor boxes will be submitted in a separate report as soon as design details are completed.

Reservoir #2 will also receive the run-off from the entire mill site. Run-off is directed by proper grading of the asphalt paved mill site toward a ditch at the west side of the mill terrace parallel to the North - South embankment of the water storage reservoirs.

A curb surrounding the mill site will prevent any run-off or ponding water from escaping otherwise into the environment.

The site run-off ditch ends at a manhole drop structure from where it will continue to discharge by gravity through the epoxy coal tar steel pipe of 900 mm diameter into Reservoir #2. The same manhole will also be used as discharge point for the tailings water return line and a recycle line from the monitoring ponds in the event that the contents of a pond was found unacceptable for discharge into the environment.

The crest of the reservoir embankments is designed at elevation 539.0, whereas the monitoring ponds raise up to elevation 541.00 and the mill site terrace to an average of 542.0. This allows for discharge from all mill facilities into the water storage reservoirs. The bottom elevation of the reservoirs is at about 531.0 m which yields approximately the following total volumes:

Reservoir #1: maximum storage volume = 233,000 m^3
Reservoir #2: maximum storage volume = 117,000 m^3

However, KLMC will operate both reservoirs in a manner that water levels are held at reasonably low levels. A general description for the use of contaminated water is contained in Section 13 of Amendment #4.

Maximum operating level in the reservoirs has been selected at elevation 537.5, giving about 1.5 m of free board.

At elevation 537.5 the volume of water stored in both reservoirs is about 260,000 m^3.

It is not foreseen that this volume will ever be held in storage except after extreme run-off events. During normal conditions the water levels will be held well below the elevation 537.5.

To R&B, FSM
+ file
K
U4-8-7.

Key Lake Mining Corporation

229 Fourth Avenue South, Saskatoon, Saskatchewan, Canada S7K 4K3. Tel (306) 665-7000. Telex No. 074-2850.

July 11, 1983

Mr. A. B. Dory,
ATOMIC ENERGY CONTROL BOARD

Mr. R. R. Sentis,
SASKATCHEWAN ENVIRONMENT

Dear Sirs:

Subject: Key Lake Liners

We wish to bring to your attention that liners installed as seals in #1 and #2 water storage reservoirs, all five monitoring ponds and the industrial water storage pond are showing signs of failure due to delamination of hypalon sheets and polyester scrim. It appears that failure continues to occur universally and randomly.

This occurence is being examined by external consultants, manufacturers and installers. Key Lake Mining Corporation is of the opinion that the liners cannot effectively be repaired. We would, therefore, like to advise you that we have chosen to replace the hypalon liner with high-density polyethylene liner. HDPE is being used widely throughout the industry for environmental protection purposes. Replacement work is to commence shortly in order to restore the ponds before the commencement of operations and the onset of winter conditions.

Yours very truly,

KEY LAKE MINING CORPORATION

Dr. F. G. H. Jantzon,
Executive Vice President

FGHJ:bmo

APPENDIX E

APPENDIX E

Province of Saskatchewan

DEPARTMENT OF THE ENVIRONMENT

Certificate No. 1642-356

CERTIFICATE OF APPROVAL TO OPERATE

Issued Under the Authority of The Water Resources Management Act, 1972 and The Air Pollution Control Act.

Approval is hereby granted to Key Lake Mining Corporation, to operate industrial wastewater and stormwater works and a sulfuric acid plant at the Key Lake uranium mine/mill complex near Key Lake, Saskatchewan. This Approval is issued subject to the term and conditions stated below.

Term of Approval: To expire February 29, 1984.

Conditions of Approval

1. All aspects of construction and operation of the approved industrial wastewater and stormwater works and of all other facilities at the uranium mining and milling operation shall be conducted in such a manner as to minimize the effects on ground and surface water quality and on the aquatic and terrestrial ecology.

2. As much clean water as practically possible shall be diverted away from the areas of the project where contamination could occur.

3. All waters that become contaminated from the mining operations, including pit water, truck wash water, and contaminated runoff from storage sites, shall be collected and transported to the tailings management area or the mill wastewater treatment system.

4. Monitoring programs shall be conducted by the Key Lake Mining Corporation in accordance with attached Appendices A, B, C and D. Sampling and analytical methodology shall be the methogology that is acceptable to the Saskatchewan Department of the Environment. The monitoring requirements may be amended in writing by the Saskatchewan Department of the Environment.

5. The results of the air and water monitoring programs shall be submitted to the Saskatchewan Department of the Environment as a monthly report in a form acceptable to the Department and within six weeks of the end of the calendar month being reported. Key Lake Mining Corporation shall review the data prior to submission with respect to accuracy and completeness, effluent quality limits and Saskatchewan Surface Water Quality Objectives. The company shall explain reasons for any unusual results or limit excursions and shall initiate remedial actions if required.

..... 2

Dated at Regina, Saskatchewan, this 30th day of June A.D 19[illegible]

Approved

Deputy Minister
Department of the Environment

6. The facility and all plans and records pertaining to the operation of the facility shall be made available at all reasonable times for inspection by representatives of the Saskatchewan Department of the Environment.

7. The levels of substances in the effluents from the operation at the last point of control shall be as low as practicably achievable, but shall not exceed the limits as specified in the attached Appendix E. The last point of control is the discharge into Wolf Lake from the monitoring ponds.

8. Samples of treated domestic water shall be collected and submitted to the Provincial Laboratory once per month, for determination of bacteriological quality.

TO CI

9. Unless otherwise directed by the Saskatchewan Department of the Environment, a sample of the treated domestic water shall be collected and analysed for chemical quality, including toxic chemicals and radionuclides, annually.

10. Operating records of the domestic water treatment system shall be maintained and submitted annually to the department. This report shall be separate and apart from the annual environmental report.

11. The ground water dewatering system constructed for the purpose of pumping ground water from the vicinity of the Gaertner ore body at a maximum rate of 90,000 cubic metres per day shall be operated as detailed in plans and specifications contained in:

    1) a submission from Uranerz Exploration and Mining Limited to the Saskatchewan Department of the Environment on December 19, 1978,

    2) submissions from Key Lake Mining Corporation to Saskatchewan Department of the Environment on July 13, 1979, August 2, 1979, August 8, 1979, July 17, 1980, and July 25, 1980.

TO PI

    3) an application from Key Lake Mining Corporation to the Saskatchewan Department of the Environment on August 31, 1981.

12. All of the ground water pumped from the dewatering wells shall be discharged into Horsefly Lake through the system designed for that purpose or used for municipal or industrial purposes.

13. The levels of substances in the water discharged from the dewatering system at the discharge point into Horsefly Lake (Mannole No. 1) shall not exceed the limits as specified in the attached Appendix F. The levels of these substances shall be monitored to detect trends in the concentrations and to ensure that the limits as specified are not exceeded. If the levels of substances exceed the limits as specified in Appendix F, the Key Lake Mining Corporation shall immediately notify the Department and shall immediately take steps to identify the cause of the problem and take whatever measures are required to rectify the problem and ensure that the limits are not exceeded.

NOTE

14. Key Lake Mining Corporation shall conduct a hydrogeological monitoring program in accordance with the attached Appendix A, Section 8. The monitoring requirements may be amended from time to time in writing by the Department. Sample collection and analytical procedures shall be those acceptable to the Department.

15. The Key Lake Mining Corporation shall submit a report to the Department by August 31, 1983 detailing the sources of elevated radionuclide concentrations in the Gaertner dewatering system. The report shall also detail a remedial action program that will be implemented in order to achieve the Saskatchewan Surface Water Quality Objectives at Annole #1 by November 1, 1983. In the interim during the remedial action program, contaminated wells shall be directed to water storage reservoirs or the T.M.A.

16. An annual environmental report based on the 1983 calendar year shall be submitted by April 30, 1984 to the Saskatchewan Department of the Environment. This report shall include:

    a) data from the environmental monitoring programs, summaries and interpretation of the data, performance with respect to discharge limits, and documentation of any past or proposed operational changes, changes in the treatment systems or any significant events that could affect the environment.

    b) results of the hydrogeological monitoring program including summaries and detailed interpretation of the information, performance of the monitoring ponds, performance and volume of seepage from the water storage reservoirs, and performance of the tailings management systems.

    c) documentation and interpretation of the measurements recorded for the Surface Movement Monuments situated at the Tailings Management Area.

17. In the event of spills of materials, unusual events or releases of materials that could affect the environment, the company shall immediately notify Saskatchewan Environment at the 24-hour spill response number (1 or 112-800-667-3503). The company shall undertake whatever remedial measures are deemed necessary to minimize any adverse effects on the environment.

18. On a semi-annual basis, the company shall duplicate the Mines Pollution Control Branch monthly sampling and analyses (at the discharge station at Wolf Lake) for the parameters specified in Station 1.3 of Appendix A.

19. Prior to completion and/or abandonment of any of the disturbed areas at the uranium mine/mill site the company shall prepare and submit for the approval of the Minister of the Environment a detailed final abandonment and reclamation plan for the disturbed area, including a schedule and committment to undertake the proposed site decommissioning.

APPENDIX I

KEY LAKE MINING CORPORATION
AQUATIC MONITORING REQUIREMENTS
PAGE 1

	LOCATIONS[1]	PARAMETERS[2]	FREQUENCY[3]
1. Discharges	1.1 Camp Sewage	TKN, NH_3, NO_3-N, P-total, P-ortho, TOC, BOD, TSS, VSS, Cl, Conductivity, pH, Temperature, Alkalinity	Q
		Total Coliform Bacteria, Fecal Coliform Bacteria	Q
		Ra-226, U	M
	1.2 Dewatering Well Discharge (Manhole #1)	Quantity	Monthly Average of daily Measurement
		pH, Temperature, Conductivity, U, Ra-226, As, Cu, Pb, Zn	W
		Ca, Mg, K, Na, CO_3, HCO_3, SO_4, Cl, TKN, Total PO_4, TSS, Pb-210, Fe, Mn, Ba, Al, Ni	M
		Po-210, Th-230, Cd, Co, Cr, Hg, Mo, Se	SA
	1.3 Mill Effluent Discharge to Monitoring Ponds	Volume	Monthly Average of daily Measurement
		As, Cu, Pb, Ni, Zn, TSS, Ra-226, U, Temp, pH, Cond.	Daily[3]
		Ca, Mg, K, Na, CO_3, HCO_3, SO_4, Cl, TKN, TOC, NH_3, Total PO_4, TSS, Pb-210, Fe, Mn, Ba, Al, Po-210, Th-230, Cd, Co, Cr, Hg, Mo, Se, V	Weekly[3]
2. McDonald - Outlet Creeks	2.1 McDonald Lake (near inflow from Little McDonald Lake)	pH, temperature, Conductivity, Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, V, Zn, U, Ra-226, Pb-210, Po-210, Th-230, Ca, Mg, K, Na, CO_3, HCO_3, SO_4, Cl, PO_4, TKN, NH_3, TOC, TSS, Turbidity	SA
	2.2 Outlet Creek (above Wheeler River)		
	2.3 Wheeler River (below Outlet Creek)		
	2.4 Russell Lake (at downstream end)		
	2.5 McDonald Creek (at stream discharge station)	Flow	Monthly Average
		pH, Cond. Temp., U, Ra-226, Pb-210, Zn	M
		Al, As, Ba, Cu, Fe, Mn, TSS, TKN, PO_4	Q
		Ca, Mg, Na, Cl, CO_3, HCO_3, SO_4, Cd, Co, Cr, Hg, Mo, Ni, Pb, Se, V, Po-210, Th-230	SA

		LOCATIONS[5]	PARAMETERS[2]	FREQUENCY[3]
		3.1 Raven Lake	TKN, NH_3, NO_3-N, P-total, Ra-226, U, P-ortho, TOC, BOD, TSS, VSS, Cl, Conductivity, pH, Temperature, Alkalinity, Total Coliform Bacteria, Fecal Coliform Bacteria	Q
TO C	3. David Creek System	3.2 Springs South West of Wolf Lake	pH, Temperature, Conductivity, Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, V, Zn, U, Ra-226, Pb-210, Po-210, Th-230, Ca, Mg, K, Na, CO_3, HCO_3, SO_4, Cl, PO_4, TKN, NH_3, TOC, TSS, Turbidity	M
		3.3 Delta Lake		
		3.4 Wheeler River Martin Lake Outflow		
		3.5 Wheeler River Downstream of David Creek		
		3.6 David Creek (at Stream Discharge Station)	Flow	Monthly Average
			pH, Temp., Conductivity, TSS, Ra-226, Al, As, Ba, Cd, Co, Cr, Cu, Fe, Hg, Mn, Mo, Ni, Pb, Se, V, Zn, U, Ra-226, Pb-210, Po-210, Th-230, Ca, Mg, K, Na, CO_3, HCO_3, SO_4, Cl, TKN, NH_3, PO_4, TOC, turbidity	M
TO F	4. Lake Levels	Murray, Carl, Tan, Kathy, Lower Key, Peter, Mink, Raven, Fox, Wolf, Frank, Key, Martin, Murphy, Gerald, Southern Seahorse, McDonald, Horsefly, Hourglass, Black, Wrobel, Douglas, Jean Lakes	Lake water elevation	SA
	5.	Ground Water (Piezometers) Pit Area	Elevation[4] Contours	SA
	6.	Potable Water Supply	See Certificate of Approval to Operate #1258	SA
NOT	7. SO_2 Lakes	7.1 Northeast Lake 7.2 Northwest Lake 7.3 Kirchner Lake 7.4 Black Forest Lake	pH, Conductivity, Alkalinity, SO_4, TKN, NO_2-NO_3	SA

		LOCATIONS[5]	PARAMETERS[2]	FREQUENCY[3]
	8. Tailings Management Areas	Tailings Pond Supernatant Recovery Water	Flow	Monthly Average
		Tailings Pond Seepage Recovery Water	Temp, pH, Cond., As, Cu, Pb, Ni, Zn, Cd, Cr, Fe, Co, Hg, Mo, Se, V, Mn, Ba, Al, Ca, Mg, K, Na, CO_3, HCO_3, SO_4, Cl, TKN, Total PO_4, TSS, Ra-226, U, Po-210, Th-230, Pb-210	Q
		Water Storage Reservoir #1	Volume	Monthly
TO C		Water Storage Reservoir #2	pH, Cond, As, SO_4, Cl, Ra-226, U	Q
1		Tailings: Pneumatic Piezometers No. TP1-A to TP22-A (inclusive)	Piezometric Head (M H_2)	M
2			Piezometric Elevation (m)	
3		Tailings: TP1-B to TP22-B (inclusive)		
4		Tailings: Standpipe piezometers No. TS1-A, TS2-A, TS3-A, TS4-A, TS1-B, TS2-B, TS3-B, TS4-B, TS5, TS6, TS7, TS8, TS9, TS10, TS11	Water Level Elevation pH, Conductivity, Temp, Ca, SO_4	M
5			pH, Conductivity, Temp, TSS, Mg, K, Na, Cl, Ca, SO_4, P (tot), TKN, As, Ni, Zn, Cr, Pb, Fe, Mn, Cu, Cd, Co, Hg, Al, Mo, Se, V, U, Ra-226, Pb-210, Water level elevation	Q[5]
TO PI		Water Reservoirs: Standpipe Piezometers No. SR1-A, SR1-B, SR1-C, SR2-C, SR3-C	pH, Conductivity Water Level Elevation	M
1			Ra-226, U, As, N	
2				Q[5]
3	9.	Ore, Cobble Ore Stockpile Seepage Collection System	pH, Temperature, Cond., U, Ra-226, As, Cu, Pb, Zn, Ca, Mg, K, Na, CO_3, HCO_3, SO_4, Cl, TKN, Total PO_4, TSS, Pb-210, Fe, Mn, Ba, Al, Po-210, Th-230, Cd, Co, Cr, Hg, Mo, Se	SA
NOTE		Special Waste Stockpile Seepage Collection System		

1. Location - see attached map - Figure 1.

2. Unless otherwise specified, parameter concentrations are to be measured and reported as "total" measurements.

3. Frequency: D - composite sample collected once per day

W - weekly - once per calendar week

M - monthly - once per calendar month

Q - quarterly - once every three calendar months

SA - semi-annually - once every six calendar months

4. Ground water level monitoring shall be conducted to allow the accurate determination of the dewatering cone of depression. A detailed map showing ground water levels and ground water level contours, shall be submitted to the Saskatchewan Department of the Environment on a semi-annual basis.

5. Hydrogeological monitoring samples obtained from the piezometer grid for the purpose of analyzing radiochemical and heavy metal values should be passed through a 0.45 micrometer filter prior to analyses.

TO C

TO P

NOTE

APPENDIX B

KEY LAKE MINING CORPORATION
AIR QUALITY MONITORING

	LOCATIONS[1]		PARAMETERS	FREQUENCY
Hi-Vols	10.1 Mill Hill 10.2 Crusher 10.3 Permanent Camp		Particulates (ug/m^3)	24 hours [2] every 6 days
			Ra-226, Pb-210, Th-230, (Bq/m^3), U, As, Ni, Pb, Zn, Cu, Se (ug/m^3)	Q[3]
SO_2 Analyzer	11.0 Mill Hill		SO_2 (ug/m^3)	Continuous Monitoring [4,5]
Stack Gas		Sulfuric Acid Plant Main Stack	Sulfur Dioxide Kg/day	Daily
See Note 6		Sulfuric Acid Plant Main Stack	Sulfur Dioxide, Sulphuric Acid Mist (mg/m^3) (kg/hr)	A
See Note 7		Yellow Cake Plant Dryer Stack	Particulates (mg/m^3)	A
			Ra-226, Pb-210, Th-230, (Bq/m^3), U, As, Ni, Pb, Zn, Cu, Se (ug/m^3)	A
Integrated Radon	12.1 Northwest Lake 12.2 Northeast Lake 12.3 Douglas Lake 12.4 Kapesin Lake 12.5 Black Forest Lake		Rn-222 (Bq/L)	SA

1. Location - See attached map Figure 1.

Footnotes:

2. The high volume method and monitors as outlined in Environment Canada Standard Reference Methods (Report EPS 1-AP-73-2, January 1973) shall be used for this purpose. The High Volume monitors shall be calibrated at least twice during the term of this permit according to the report EPS 1-AP-73-2. The High Volume monitors shall be maintained and operated such that at least twenty-five valid samples be collected from each monitor during a consecutive six month period.

3. For each station a composite of all sample filters used to collect particulate samples every 6 days.

4. The company shall conduct at least one multipoint calibration of the ambient sulfur dioxide monitor consisting of a minimum of four different certified gas concentrations, one of which may be zero parts per hundred million.

5. Report - Hourly levels
- Maximum hourly level during month
- Maximum 24 hour mean during month
- Monthly mean of hourly concentrations
- Percentage of times that hourly level exceeds 17 parts per 100 million.

Note:

The annual environmental report (see Condition 16 of Certificate) shall include a summary of the results of the air monitoring programs, including:

a) the 24 hour average concentrations of particulate matter measured at each monitor location;

b) the trace element analyses performed on the High Volume monitor filters;

c) the monthly one hour maximum, monthly 24 hour maximum average, monthly and annual average concentrations of sulfur dioxide obtained with the continuous ambient SO_2 monitor; and

d) the results of calibrations of the instruments.

6. a) The stack sampling survey to determine the concentration of sulfur dioxide and the amount of sulphuric acid mist emitted from the acid plant main stack shall follow the reference methods published by Alberta Environment (Publication SSC-1/76, Method 5) or the United States Environmental Protection Agency (U.S. Federal Register, Volume 36, Number 247, December 23, 1971). A sampling survey shall consist of three separate tests performed on three different calendar days, while the plant or process is operating under normal conditions and production rates.

b) The stack survey report shall be submitted not later than 60 days following the completion of the testing and shall include the following:

1) calculated concentrations and flow rates of sulphur dioxide and sulphuric acid emitted from the sulphuric acid plant main stack in units of mg/m^3 and kg/hr on both wet and dry bases.

2) results of process efficiency tests carried out on the sulphuric acid plant on the same days that the stack survey is carried out.

3) estimate of annual emissions based on the results of the stack survey.

7. a) The stack sampling survey to determine the concentration of particulate matter emitted from the yellowcake plant dryer stack shall follow standard reference methods as published by Saskatchewan Environment (Report APC 31, August, 1981). The sampling survey shall consist of a cumulative sample extracted at the number of points specified in the standard reference methods and located along two perpendicular traverses, while the plant is operating under normal conditions and production rates.

b) The trace element analyses shall be carried out on the particulate matter collected on the sampling train filters used during the stack sampling.

c) The stack survey report shall be submitted not later than 60 days following the completion of the testing.

APPENDIX C

KEY LAKE MINING CORPORATION
AQUATIC BIOTA & SEDIMENT MONITORING
REQUIREMENTS

MEDIA		LOCATION[1]	PARAMETERS[2]	FREQUENCY
Macrophytes[4]		M-1 McDonald Creek at Outlet of McDonald Lake	Species, Weights[3], Pb-210, Ra-226, U, Th-total, As	Annually
		M-2 Delta Lake		
		M-3 Wheeler River above David Creek		
		M-4 Wheeler River below Outlet Creek		
Fish[5]	Northern Pike (Esox lucius)	F-1 McDonald Lake F-2 Delta Lake	Fork length, Weight[3], Ra-226, Pb-210 U, Th-total	Annually
	Lake Whitefish (Coregonus clupeaformis)			
	Lake Whitefish (Coregonus clupeaformis)	F-3 Russell Lake	Fork length, Weight[3] Ra-226, Pb-210, U, Th-total	Annually
	Northern Pike (Esox lucius)			
Sediments		S-1 McDonald Creek at Outlet of McDonald Lake	U, Ra-226, Pb-210, Th-230, As, Ni, Pb, LOI, Moisture, TKN, TPO_4, TOC, SO_4, Ca	Annually
		S-2 David Creek downstream of Yak Creek		
		S-3 Delta Lake		
		S-4 Russell Lake		

1. Location - See attached map Figure 1.
2. Parameters - Report analytical parameters on a dry weight basis.
3. Weight - report wet weight, dry weight and % ash weight.
4. Macrophytes - Collect representative samples of submergent and emergent species at each station and ash for analyses.
5. Fish - Collect 5-10 fish of each species using standard gang gillnet sets.
   - Separate bone and flesh (muscle without skin).
   - Composite bone and flesh samples of each species and analyze.
   - Report parameters as average levels in bone and flesh of each species at each station.

APPENDIX D

KEY LAKE MINING CORPORATION
SOIL AND TERRESTRIAL BIOTA MONITORING

	LOCATIONS[1]	PARAMETERS	FREQUENCY[2]
SOIL	12.1 Northwest Lake 12.2 Northeast Lake 12.3 Douglas Lake 12.4 Kapesin Lake 12.5 Black Forest Lake	Soil expressed on a dry weight basis: Moisture, pH, As, Ni, U, Ra-226, Pb-210, Th-tot, SO_4	once every two years 1984
PLANTS	12.3 Douglas Lake 12.4 Kapesin Lake	Plants expressed on a dry weight basis: species[3], Ash, As, Ni, Pb-210, Po-210, Ra-226, Th-tot, U	once every two years 1984
SO_2 LICHEN	13 Marmot Lake	% occurrence of each lichen species[4], % cover of each species, tot. S.	once very two years 1984

1. Location - see attached Figure 1.

2. Soil and plants each to be sampled in triplicate at each location and each sample to be analyzed individually.

3. Blueberry and lichen (a Cladina species preferably) to be collected at each site. The blueberry samples should be aboveground stem and branches minus leaves and berries.

4. % occurrence and % cover for, and tot. S in a sample collected from, each of 10 subplots.

APPENDIX E

KEY LAKE MINING CORPORATION
EFFLUENT QUALITY LIMITS

SUBSTANCE	MAXIMUM MONTHLY ARITHMETIC MEAN CONCENTRATION	MAXIMUM GRAB SAMPLE CONCENTRATION
Arsenic	0.5 mg/L	1.0 mg/L
Copper	0.3 mg/L	0.6 mg/L
Lead	0.2 mg/L	0.4 mg/L
Nickel	0.5 mg/L	1.0 mg/L
Zinc	0.5 mg/L	1.0 mg/L
Total Ra-226	0.37 Bq/L	1.1 Bq/L
Total Suspended Solids	25 mg/L	50 mg/L
Ammonia	15 mg/L	30 mg/L

pH: the pH of the discharged wastewater shall be maintained equal to or greater than 6.0 in 75 per cent of collected samples and the pH levels of single samples shall never be less than 5.0.

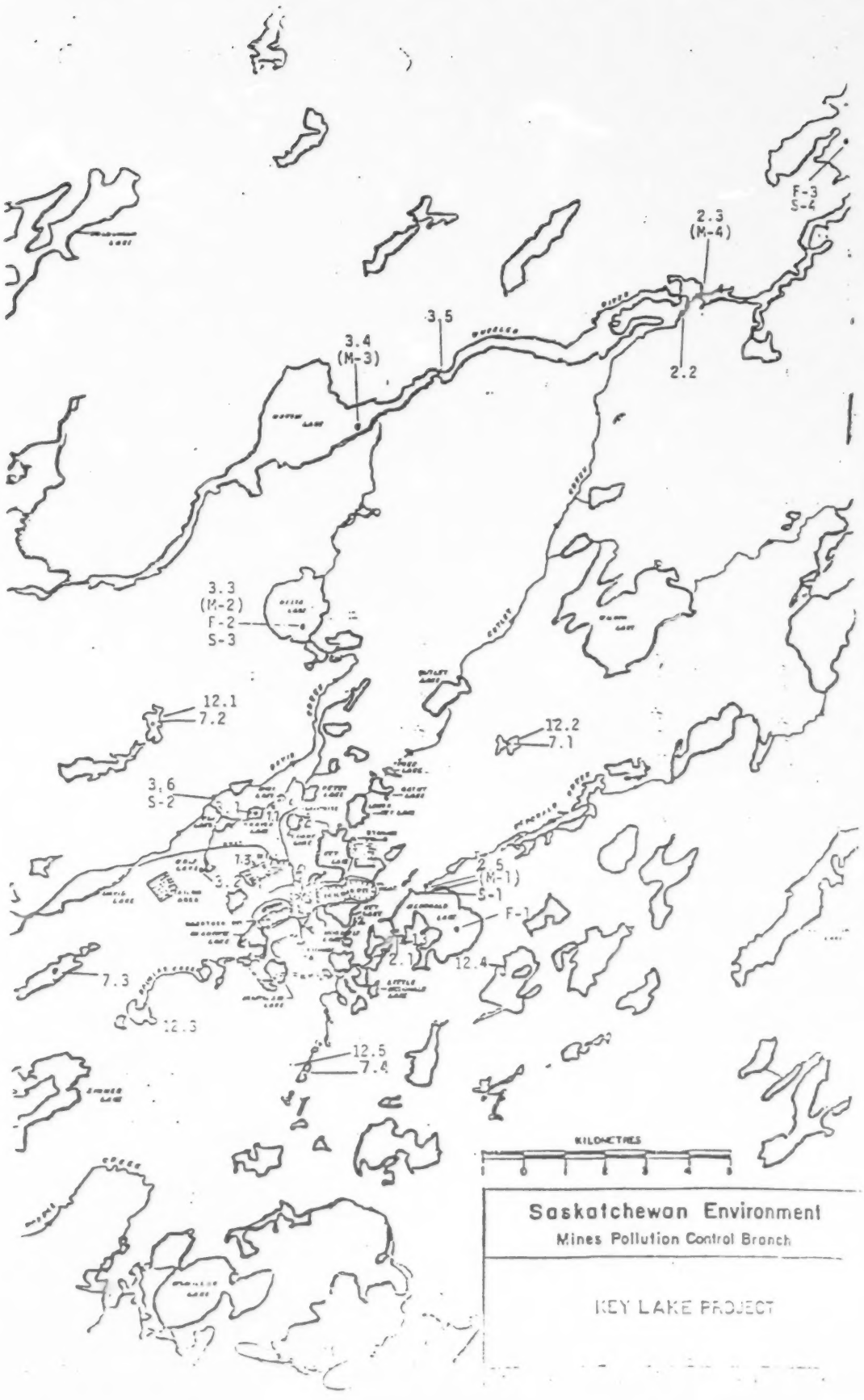
APPENDIX F

KEY LAKE MINING CORPORATION
DEWATERING WATER QUALITY LIMITS

SUBSTANCE	ALLOWABLE MAXIMUM MONTHLY ARITHMETIC MEAN CONCENTRATION (AS MONITORED IN ACCORDANCE WITH CONDITION 13)
Radium-226	0.11 Bq L[1]
Arsenic	0.11 mg L[2]
Copper	0.02 mg/L
Lead	0.05 mg/L
Zinc	0.05 mg/L
Uranium	0.08 mg/L

1. Bq.L - Becquerels per Litre

2. mg/L - milligrams per Litre


F-3
S-4
2.3
(M-4)
2.2
3.5
3.4
(M-3)
3.3
(M-2)
F-2
S-3
12.1
7.2
12.2
7.1
3.6
S-2
1.1
1.2
1.3
2.5
(M-1)
S-1
F-1
2.1
12.4
7.3
12.3
12.5
7.4
KILOMETRES
0 1 2 3 4 5
Saskatchewan Environment
Mines Pollution Control Branch
KEY LAKE PROJECT

APPENDIX F

Government of Saskatchewan

APPENDIX F

Memorandum

From Mines Division
Mines Pollution Control Branch

Date February 15, 1983

Phone

To File

Your File

Our File U4-8-9-2

Re JANUARY INSPECTION OF KEY LAKE SITE

On January 19, 1983 at 1430 hours Kevin Scissons and I arrived on site to inspect the Key Lake site. The contact persons on site were Joe Spross, Nick Holl, Eldon Krahn and Mike Behrune.

Tailings Management Area

Construction crews are working on the containment structures for the tailings line. No other activity.

Gartner Pit

The pit has been excavated to a depth of 44 metres. The pit is experiencing more water than expected. Mr. Holl outlined a plan for the establishment of a set of pit sumps which would be pumped via a new pipeline to A monitoring pond at the mill. This pond would have sufficient capacity until June or until the utilidor is complete. KLMC will be consulting us regarding finalized mine water handling options in the near future.

A drill pattern was being established for what appeared to be blast preparation.

There was no obvious glaciation on the pit walls.

KLMC is now operating on a twenty four hour mining schedule.

Ore Cobble Ore and Special Waste

Both areas are active. No water problems due to winter conditions. Spring runoff must be carefully monitored.

Main Activity

The main areas of concentrated activity is related to construction at the Crush-Grinding facility and the mill area.

Permanent Camp

Projected completion April or May.

Samples

- McDonald Creek
- Inflow of Horsefly Lake (Manhole #1)

Follow-up

- Assess and attach sample results
- Await mine water handling proposal

R.G. Barsi
Mines Division

RGB/ph

cc Bill Whitehead
Peter Courtney

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date March 9, 1983

Phone

To File

Your File

Our File U4-8-9-2

Re FEBRUARY 1983 INSPECTION OF KLMC

On February 18, 1983 at 1300 hours Kevin Scissons and the undersigned arrived on site to collect water samples and inspect the KLMC operation. We were met on site by Kent Santo of the KLMC Environmental Section.

Photographs were taken and will be placed in the MPCB photo library.

Observations:

Tailings Management Area

- Construction crews were in the process of installing the concrete containment structure for the tailings line.

- No other activities were in progress in the T.M.A.

Mill and Maintenance Buildings

- Construction on both facilities appears to be progressing rapidly.

Gaertner Pit

- KLMC have constructed 3 sumps (sump #1 & 3 west side, sump #2 north side of mining area) to intercept ground water flow from entering the mining area. Mr. Courtney indicated that transfering of sump water to the dewatering wells was causing problems with wells sanding out. As a result they now transfer the sump water from sump #1 and #2 to the designated semi permanent central sump #3, where it is then transferred to the main dewatering culvert. As soon as the transfer line in the utilidor is installed, mine water will be pumped from sump #3 to water storage reservoir #2 for holding.

Ore, Cobble Ore and Special Waste Area

- Stockpiling of ore grade material was in progress at both facilities.

Samples

- McDonald Creek
- Inflow to Horsefly Lake (Manhole #1)

Follow-up

- Assess and attach sample results
- Collect a water sample from each of the sumps and analyse for Ra-226.

J.S. Meekma
Mines Division

JSM/ph

cc Bill Whitehead
Peter Courtney

Government of Saskatchewan

Memorandum

A

From Mines Pollution Control Branch

Date April 8, 1983

Phone

To File

Your File

Our File U4-8-7

Re Mine Sumps - Wells

On March 28, 1983 the KLMC Gaertner pit water handling facilities were inspected to ensure compliance with the March 23, 1983 letter from MPCB to KLMC which requires an immediate decrease in the suspended solid levels in the pit dewatering discharge. I was accompanied on site by Josef Spross.

Mr. Spross stated that environmental protection had not been sufficiently considered by the dewatering crews when they had rigged the previous system. Subsequent to our March inspection and reaction to inadequate environmental protection KLMC has altered the dewatering system in the following manner:

- Until April 21, 1983 water from Sumps #1 and #3 and from wells A and B will be pumped and stored in Upper Seahorse Lake. The necessary handling facilities had been installed and were operational.

- Sump #2 was being pumped to a down line position of Well EE. (Subsequent discussions with KLMC has indicated that this method has not been adequately successful. Consequently the system has been altered. Sump #2 now discharges to a depression approximately 25 metres east of well EE. This will allow the mine water to filter through the substrate prior to removal by the dewatering well.)

Spross stated that the requested monitoring would be performed ie:

- the sumps will be monitored on a daily basis to ensure adequate water clarity.

- two samples per week will be collected from Manhole #1 and the results sent to MPCB as soon as possible.

The inspection revealed that KLMC has installed the necessary facilities to handle the pit water until April 21, 1983. Water quality monitoring of Manhole #1 will demonstrate whether or not this system is successful.

As of April 21, 1983 mine water from all sumps and contaminated dewatering wells will be pumped to and stored in Reservoir #2 to whatever extent is necessary to ensure environmental compliance at Manhole #1.

R.G. Dursi
Mines Division

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date May 9, 1983

Phone

To File

Your File

Our File U4-8-9-2

Re APRIL 1983 INSPECTION AT KEY LAKE

On April 26/83, R.G. Barsi and the undersigned performed the monthly inspection of the KLMC facilities. On site contacts were Eldon Krahn and Mike Behrand.

(1) Special Waste

The large stockpile of special waste is not all properly contained within the dyked area. Some material has been pushed up to and on top of the dykes. The large mound of waste has also been piled too close to the edge and the potential for escaping runoff exists.

Remedial measures are necessary.

(2) Ore and Cobble Ore

This area appears to be better contained. All contaminated water is to report to the sumps. Stockpiling is still continuing in both areas.

A sample of ponded water collecting on the east side of the cobble ore storage area is being analysed to verify if it is possible seepage.

(3) Tailings Management Area

Installation of the concrete utilidor containing the tailings lines, wiring etc. has been nearly completed. Preparation of the insulated half culvert that is to cover the utilidor is still underway.

A backhoe was operating in the area of the east main embankment.

(4) Gaertner Pit

According to M. Behrand, contaminated water from the pit sumps

is reporting to the Crushing Area Sump. Approximately twice per day that sump is manually turned on to direct this water to Reservoir #2 at the mill via the new utilidor (start-up began April 21/83 on this new handling system). The manual control is regulated by a visual check of flags tied on the ladder rung. The highest flag is to designate that pumping should begin. It takes approximately 2 hours of pumping to lower that sump to the second flag. Only pit sump water is currently being handling by the new utilidor to Reservoir #2. Pump capacity problems and line breaks have temporarily prevented pumping from any of the contaminated wells. Mr. Behrand feels that this pumping system should also be able to handle some of the higher contaminated wells in the pit area once the larger pump is in place at the crusher sump.

Excavation and loading of the ore is quite sloppy due to the present pit water levels. This condition may not change.

Pit expansion further to the west towards Seahorse Lake is also under way.

They are currently discharging 1,070,000 m^3/month of dewatering water into Horsefly Lake.

(5) Seahorse Lake

Contaminated pit water is no longer being discharged to the upper end of Seahorse Lake. Some organic bottom sediments from the Gaertner area have been placed here.

No water is being pumped out of the lower end of Seahorse Lake.

(6) Mill Area

Reservoir #1 contains local runoff water and snow melt. It will not be used until its liner's integrity is tested this spring.

Reservoir #2 (total volume available is 117,000 m^3) is receiving pit sump water via the new utilidor system from the crushing area. Holding capacity should be adequate for up to 2½ months at present inflow rates.

(7) Followup

- Special waste area should be dressed to prevent contaminated

runoff and overflow of waste onto the dykes.

- An improvement in the dewatering water quality should continue once the higher contaminated wells are diverted to Reservoir #2. Confirmation of this from KLMC should be coming in the near future.

- The Approval to Operate is currently being drafted. Implementation date is scheduled for June 30/83 following a licencing meeting with the company on June 17.

- Review and attach the SRC results of the two water samples collected.

K.H. Scissons
Mines Division

KHS/ph

cc Bill Whitehead
P. Courtney

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date May 24, 1983

Phone

To File

Your File

Our File U4-8-9-2

Re MAY INSPECTION OF KLMC MINE SITE

On May 17, 1983 Randy Sentis, Sheldon McLeod, and I inspected the Key Lake operation. We were accompanied on site by Peter Courtney and Kent Santo.

Special Waste Storage

The special waste storage area has been cleaned up since last month's inspection. Any material that had encroached upon the containment dykes has been returned to within the storage structure. It is evident that any standing water that accumulated in the storage area has been hauled to Reservoir #2.

Crush/Grind Area

Construction continues on the Crush/Grind facility. Peter Courtney indicated that there may be a change in the details of construction for this area. The original plans call for a bentonite seal to be placed around the haul/dump area. Due to contractual problems and the expense involved KLMC is considering not placing the bentonite as originally planned. KLMC should be reminded that this area is referenced in Certificate of Approval to Construct #5349 Condition A, with specific reference to page 4-14, Table 4-3 of the report titled - Amendment No. 5, to the "Final Site Application". "Construction Details on Contaminated Water Storage Reservoirs, Monitoring Ponds, Ore and Special Waste Storage and Design Report on Contaminated Water System" dated February 1982. Any modification to the approved construction plans should be agreed to by the Regulatory Agencies.

It is our belief that a bentonite seal in the crush grind area is necessary due to the proximity of dewatering wells V, W and X which supply this operations potable water supply. It is expected that groundwater contamination in this area would require remedial action both for occupational health and environmental reasons, since these wells move approximately 40% of all dewatering flows.

Gaertner Pit

Pit development continues with expansion to the west continuing. Pit conditions were not as wet as previous inspection. All pit water is being collected and pumped to Reservoir #2.

Gaertner Dewatering System

Wells A, B, BB and U are being pumped to Reservoir #2 via the crush/grind sump. Courtney indicated that even with the west side in pit wells being directed to the storage reservoir the radium values at Manhole #1 are still elevated. Consequently, the company is performing a well water quality survey to assess which wells are responsible. Initial indications are that well Q may be contributing contaminated water to the system.

Deilmann Dewatering System

Hayter drilling has been successful to date in the development of this system.

Ore-Cobble Ore Storage

This site is being well maintained. The ore stockpiling continues as scheduled. During our previous inspection Krahn had indicated that a small low area below the stockpile berm was holding water. KLMC personnel suspected that this may be seepage from the storage facility so they sampled the water. Courtney stated that sample analysis showed Ra-226 levels elevated at 0.5 Bq/L while the remaining parameters were all very low, uranium included. This has prompted him to believe that the standing water, which has since seeped away, was not seepage but localized runoff. The reason for the elevated radium values in this area should be determined.

Water Storage Reservoir #1

This storage reservoir is receiving only localized runoff water. Since the integrity of the liner has not been ascertained by the contractors test program, the primary sump water levels should be monitored. This will indicate whether or not the liner is leaking and if so the volume of water that results.

Water Storage Reservoir #2

This reservoir is receiving contaminated water from the pit and wells

A, B, BB and U. This liner has been tested and its integrity ensured. The water level is presently at the one quarter to one third level.

Monitoring Ponds

The monitoring pond (s) load and dump sequence was discussed with Courtney. As yet, no firm monitoring program has been decided upon for the effluent discharge system. The main area of concern involves the rapid turn around time of sample assays for uranium and Radium 226 in order to allow daily batch discharge. Courtney indicated that a rapid analysis procedure developed by Dr. Smithson at SRC is being considered by KLMC. This analysis calls for a two hour counting period for Ra-226 with an apparent confidence level of fifty percent.

Tailings Management Area

Construction has been initiated on the east main embankment. A small amount of standing runoff water has accumulated in the tailings management area.

Upon examining the external side slopes of the tailings pond it was immediately evident that water erosion of the slopes must be controlled. Courtney stated that a proposal for the installation of erosion control systems will soon be filed with the regulatory agencies.

Certificate of Approval to Operate

I indicated to Courtney that it is our intention to have a Certificate of Approval to Operate for the KLMC operation finalized by July 1, 1983. We expect to have a draft licence in the mail for Company review by June 10, 1983 with a meeting scheduled for June 17, 1983 at 0930 hrs. KLMC office, Saskatoon.

Water Quality Sampling

Samples were obtained at the following stations:

Manhole #1 Discharge to Horsefly Lake

0945 hrs.
6°C temp.
7.3 pH
L50 Cond.

McDonald Creek

1000 hrs
5°C Temp.
7.2 pH
L50 Cond.

Follow-UP

1. Assess and attach sample results.
2. Clarify intention of KLMC regarding whether or not to install bentonite seal in crush/grind area.
3. Check with KLMC regarding follow-up contaminated well water quality survey.
4. Request that KLMC identify the source of Radium 226 contamination in the low area on the south west side of the ore-cobble area.
5. Await erosion control report from KLMC.
6. Monitor primary sump water levels.

Rob Barsi

R.G. Barsi
Mines Division

RBGB/ph

cc Scott Meekma
Bill Whitehead
Peter Courtney

Memorandum

From Mines Pollution Control Branch

Date July 20, 1983

Phone 922-2228

To File

Your File

Our File ~~0-8-9~~=2

Re JUNE 1983 INSPECTION OF KLMC

On June 8, 1983 at 0900 hrs Kevin Scissons and the undersigned arrived on site to collect water samples and inspect the KLMC operation. We were met on site by Eldon Krahn and Peter Courtney of the KLMC Environmental Section.

MPCB personnel returned to the site the following day, June 9, to pick up the automatic sampler set up at Horsefly Lake Inflow (Manhole #1) on June 8.

Observations

Tailings Management Area

- Construction on the main embankment is progressing rapidly. Crews were in the process of installing sections of the seepage recovery lines to the collection sumps.

- Crews were also working at the pumping station in the tailing dispersion area.

Water Storage Reservoirs and Monitoring Ponds

- Water storage reservoir #2 is being used to store the contaminated water from the groundwater dewatering wells. There is approximately 10 feet of freeboard remaining in the reservoir.

- Water storage reservoir #1 has not been put into operation. Apparently problems with the hypalon liner seams are being corrected. The liner is to be tested (air lance test) prior to being put into operation.

- Construction and testing of the five monitoring ponds has been completed.

Mill and Maintenance Facilities

- Construction on the mill process facilities and instrumentation is in its final stages.

- The maintenance shop has been completed. KLMC are now utilizing the offices located on the west side of the building.

Gaertner Pit Area

- Hauling and stockpiling of ore and cobble ore was in progress. Clean-up of material falling onto the confining bands has been satisfactorily completed.

- KLMC were using a tanker truck to transport contaminated runoff from the special waste area to water storage reservoir #2.

Horsefly Lake Inflow (Manhole #1)

- Observations made at the inflow to Horsefly Lake from Manhole #1 indicated there were problems occurring in the groundwater dewatering system. Horsefly Lake appeared very turbid, however the inflow appeared only moderately turbid. A conversation with Mr. Spross indicated a high volume pump had been installed in a low producing sump. Also, one of the contaminated sumps which was to be directed to water storage reservoir 2 had been inadvertently directed to Manhole #1. KLMC are presently looking into a lock out system to eliminate any future errors on this nature.

Permanent Camp

KLMC employees are now using this facility.

Sampling

1) McDonald Creek at Monitoring Station
2) Horsefly Lake Inflow (Manhole #1). A 29 hour composite sample was collected using MPSB's composite sampler.

Follow-up

1) Assess and attach SRC's results of MPCB's sample.

2) During next month's inspection observe the turbidity problems at Horsefly Lake.

J.S. Meekma
Mines Division

JSM/ph

cc G.W. Howard

Exhibit Attached

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date August 10, 1983

Phone 922-2228

To File

Your File FY.5-1-7

Our File ~~U-8-9~~-2 (KLMC)

Re JULY 1983 INSPECTION OF KEY LAKE MINING CORPORATION

On July 14, 1983 at 1330 hours Ron Barsi and the undersigned arrived on site to collect water samples and inspect the KLMC operation. We were met on site by Sean O'Farrell of the KLMC environmental section.

Photographs were taken and will be placed in the M.P.C.B. photo library.

Observations:

Tailings Management Area and Water Storage Reservoirs

- Construction on the main embankment is near completion. Construction crews were in the process of final grading the top of the embankment, also crews were working on the seepage recovery ditch.

- The tailings pond is now being utilized to store contaminated pit water. The contaminated water is being discharged over a rock platform near the center of the west embankment. The rock platform was constructed to prevent erosion of the filter sand covering. However, moderate erosion of the filter sand is occurring. The above early use of the tailings area as a water storage reservoir was necessitated by the company having to replace all the Hypalon liners in the storage and monitoring ponds.

- Water storage reservoir #2 was full at the time of inspection.

- Crews were starting to remove the Hypalon liner in storage reservoir #1.

Crushing, Grinding and Ore, Cobble Ore Area

- Crushing of ore and hauling to the blend pile was in progress. The truck load area following the crushing process was quite "messy".

- Stockpiling of ore from the Gaertner Pit is still in progress.

Special Waste Area

- KLMC have constructed an access ramp to the top of the special waste pile. The ramp is constructed outside of the special waste area, allowing better utilization of storage area.

Permanent Camp

- The permanent camp is now in full use.

Sampling

1) McDonald Creek at monitoring station.
2) Horsefly Lake inflow (Manhole #1)

Follow-up

1) Assess and attach SRC's results of MPCB's samples.
2) Inform KLMC on MPCB's concerns relating to the following:

   a) Erosion problems occurring with the filter blanket covering the T.M.A.

   b) "Messy" ore, truck loading area at the crushing and grinding area.

   c) Confirmation as to the construction of the ramp at the special waste area.

J.S. Meekma
Mines Division

JSM/ph

cc G.W. Howard

KWG-

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date September 1, 1983

Phone 922-2223

To File

Your File

Our File U4-8-9-2

Re AUGUST/83 INSPECTION AT KEY LAKE

On August 23, 1983 J.C. Hayward and the undersigned performed the monthly inspection of the KLMC facilities at Key Lake. On site contacts were S. Ofarrel and P. Courtney. Pictures of the inspection will be stored in the MPCB library.

OBSERVATIONS

1) Pit Operation

Mining of the Gaertner orebody is continuing with pit conditions appearing fairly dry. Contaminated sumps and well water are being discharged into Reservoir #1 at the mill. Mr. Courtney indicated that the lock out system for valve control of the contaminated water lines is in place.

Crushing and grinding of the ore is also continuing.

2) Liner Replacement

Reservoir #1 was back in operation following replacement of its liner. Reservoir #2 should be completed by approximately Sept. 9, and the five monitoring ponds were nearing completion. Apparently no major problems have been encountered in replacing the original Hypalon liners with this high density polyethylene.

3) Tailings Area

No further discharge of pit water into the tails pond was observed. The use of the dispersion bars appeared to work effectively in preventing further erosions of the filter blanket on the base of the pond.

A phleger pump was installed at the east end of the Tails Pond. Mr. Courtney later confirmed that this pump had recently begun transferring the ponded water back to Reservoir #1 through the provisional line that was originally used to help drain Reservoir #2.

The main collector sump located midway on the toe of the east embankment was also in operation. This was later confirmed by Mr. Courtney that they were collecting seepage water from the filter blanket area of the tails pond and also transferring this back to Reservoir #1 via the utilidor. This set up appears to be working as designed.

4) Special Waste

The access ramp to the top of the special waste stockpile now appears to be in use. Runoff control from portions of this stockpile will probably be effected. The capacity of this area appears to be reaching its limit, especially if complete control of contaminated runoff is to be considered.

5) Sewage Treatment Plant

As per a request from WPCB, an inspection of the sewage treatment facilities located north of the construction camp was performed. Confirmation of Mr. Courtney's August 3 letter to B.W. Ganong (WPCB) was undertaken, and Mr. Offarell pointed out the remedial work.

Cleanup work was still continuing and improvements through the system were observed.

Sampling

Water samples were collected from the dewatering discharge into Horsefly Lake, the stream discharge station on Yak Creek above the David Creek confluence, and [redacted].

Discussions

1) Mr. Courtney was asked if the report outlining the contamination in the dewatering system for the Gaertner Pit was complete, as requested for in condition #15 of their current approval to operate. Due date is Augsut 31, 1983. Mr. Courtney was not aware that the committment had not been met, but that the information was available. KLMC would be able to respond prior to August 31.

2) Mr. Courtney stated a retake of the Wolf Springs (creek) sample was performed on July 26, and the SRC result was just received.

This value of 0.01 Bq/L Ra-226 confirms that the original turbid sample was an anomaly (0.12 Bq/L) and not a break through of seepage from the tails area or the reservoirs.

3) The July monthly average of Ra-226 from the dewatering system discharge was at or just below the 0.11 Bq/L limit according to Mr. Courtney. If this can be maintained then the corrective measures currently in place to prevent contamination are effective. A turbidimeter is also to be installed on the discharge line to continuously monitor the dewatering quality.

Follow-up

1) Review and attach the SRC results of the water samples collected. A copy of the STP discharge will also be forwarded to the WPCB.

2) Further assess the access ramp to the special waste stockpile and confirm with KLMC the current capacity of that stockpile and the protection of the runoff control works.

3) Await report as per condition #15 of licence. This information is required prior to approving the construction of the Deilman dewatering system that is currently proposed.

4) Confirm operation of the Reservoir (s), Tails Pond, and main collector sump for handling of the contaminated pit water. Also mill start up (testing) may be commencing sometime in September and a discharge to the tails pond could begin.

K.H. Scissons
Mines Division

KHS/ph

cc P. Courtney
B. Whitehead
C.L. Potter

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date September 26, 1983

Phone 922-2220

To File

Your File E 11-5.1-7

Our File U4-8-5-2 (Key Lake)

Re SEPTEMBER INSPECTION OF KEY LAKE MINE SITE

At 1245 hrs on September 19, 1983 the following personnel arrived on site:

Alan Carr
Bill Howard
Randy Sentis
Ron Barsi

On site representatives were:

Frank Jantzon
Joe Spross
Kent Santo

Weather

The on site weather has been predominated by periods of rain. To date, the month of September has experienced 100 mm of rain as compared to the August reported level of 45 mm.

Tailings Management Area

- The provisional line that was utilized to return contaminated water from the tails pond to the contaminated water reservoirs was shut down on September 6, 1983.
- The provisional line spill area has been cleaned up, however, a gamma survey of the area should be conducted and recorded. Santo indicated that a full spill report on this site will be into our office next week.
- Surface erosion on the surface of the interior and exterior of the tailings pond is evident. Small gullies approximately 8-10 inches in depth abound throughout the surface of the structure. It is evident that the runoff control culverts are minimizing surface erosion.

- Despite KLMC's efforts, ponded water remains in the tailings pond. This area should be drained prior to freezeup in order to protect mechanical drainage facilities.

Contaminated Water Storage Reservoirs

Liner replacement has been completed.

Reservoir #1 is full and overflowing into Reservoir #2 which was approximately two-thirds full.

Effluent Monitoring Ponds

Liner replacement has been completed.

Ponds contain small quantities of rainfall and surface runoff.

Gaertner Pit

Due to recent rains the pit is in a fairly wet condition. Mining continues in the main part of the pit in addition to expanding the actual mine area to the west.

Mine water is being routed to the contaminated water storage reservoirs.

Radionuclide contamination problems have been experienced with well Q. Dewatering crews tried to discharge this well to Horsefly, however, the Ra-226 values rose to 0.26 Bq/L so KLMC redirected the flow to the contaminated water storage reservoirs.

Gaertner Dewatering System

The turbidity meter has not yet been received from the supplier. Indications are that it is on the way and will be installed as soon as received.

Ore Storage/Crush-Grind Area

Wet conditions prevailed especially in the ore chute loading area. The sumps are operating as designed.

Special Waste Storage Site

The special waste storage site is being expanded. Contaminated water collection and handling works will be installed and joined into existing system. KLMC will be submitting design details to our office in the near future, concurrent with their application for a Certificate of Approval to Construct.

The contaminated water handling sumps were operating as designed.

Residual Lake Dewatering

KLMC has constructed a trench in order to gravity drain Seahorse Lake into Hourglass Lake. This lake is subsequently pumped. At the time of inspection pumping had ceased due to low water levels in conjunction with lake sediment disruption.

Key Lake residual pond #1 has been pumped down to a sufficiently low water elevation. Key Lake residual pond #2 is presently being pumped.

Deilmann Dewatering

- All ground water exploration holes for the 1983 program have been completed.
- Seven large diameter wells have been constructed and forty-eight hour individual pump tests were performed. KLMC is collecting one grab water quality sample during the latter stages of the pump test. Santo indicated that analysis received to date have not indicated any problems.
- Monthly water levels have been documented since June from the fifty stand pipe piezometers in the area.
- During the individual pump tests all water is being contained in depressions near the well site.

Monitoring Stations

- Santo indicated that no flow readings are being reported for the David Creek station. KLMC are awaiting the arrival of a new manual meter necessary to calibrate the [illegible]atic constant meter.

- Later this month KLMC will be installing culverts into the David and McDonald Creek monitoring sites.

Compliance Sampling

Samples were collected at:

- Yak Creek stream discharge station
- Horsefly Lake inflow
- Hourglass Lake

Follow-up

- Assess and attach sample results
- Send Spill Control Group our assessment of spill(s) clean-up.
- Await KLMC Deilmann compound pump test proposal
- Await KLMC design details for the expansion of the Special Waste Storage Area.

R.G. Barsi
Mines Pollution Control Branch

RGB/ph

cc G.W. Howard
J.S. Meekma
Bill Whitehead
Peter Courtney

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date October 17, 1983

Phone

To File

Your File

Our File U4-8-9-3 ✓

Re UNANNOUNCED INSPECTION AND SAMPLING OF THE KEY LAKE MINE SITE, OCTOBER 1983

On October 5, 1983, Kevin Scissons and the undersigned travelled to the Key Lake Mine Site for an announced inspection. We reported to the main admittance gate and contacted Joe Spross. Mr. Spross then instructed us to meet him in his office. Mr. Spross indicated that Mr. Eldon Krahn would accompany us on the inspection.

Tailings Management Area

- The provisional line installed to transfer contaminated water from the tails pond to the contaminated water storage reservoirs was still in place.
- Transfer of contaminated water to the water storage reservoirs was discontinued in order to maintain a reserve capacity in the reservoirs for contaminated water being transfered from the pit area.
- Preliminary testing of the tailings aerial dispersion system has taken place.

Water Storage Reservoirs

At the time of inspection, Reservoir #1 was full (no overflow into Reservoir #2 occuring). Reservoir #2 was approximately 3/4 full.

Ore, Cobble Ore Stockpile Area

- A front end loader was in the process of removing ore stockpiled too close to the edge of the confining bund located on the west side.
- Mr. Spross had previously indicated tentative start-up of the mill is being delayed as a result of problems being encountered in the crushing circuit.

Special Waste Area

- A survey crew was in the process of carrying out a preliminary survey on the proposed extension of the special waste stockpile pad.
- Stockpiling in the special waste area appears to be near full capacity.

Gaertner Pit

Normal mining operations were in progress within the pit area. Contaminated pit water is being pumped to Water Storage Reservoir #2.

Sewage Treatment Plant

Mr. Krahn indicated that they are still experiencing problems with the operation of the treatment plant. Last week 3 out of the 4 cells were functioning. This week only 1 cell was in operation.

Monitoring Stations

Installation of culverts at David Creek and McDonald Creek has not been completed yet.

Sampling

Samples were collected at:

- Yak Creek Stream Discharge Station
- Horsefly Lake Inflow (The continuous operating turbidimeter to monitor the dewatering quality has not been installed to date).

Follow-up

- Assess and attach sample results.
- Await KLMC design details for the expansion of the special waste storage area.

J.S. Meekma
Mines Division

JSM/ph

E.L. Howard

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date December 5, 1983

Phone 922-2228

To File

Your File EV-5-1-7 V

Our File U4-8-9-2 (KLMC)

Re NOVEMBER 1983 KEY LAKE MINING CORPORATION INSPECTION

On November 24, 1983 Kevin Scissons and the undersigned performed the monthly inspection of the KLMC facilities at Key Lake. We were accompanied on site by Mr. Kent Santo. A tour of the bulk neutralization and radium removal treatment section of the mill was conducted by Mr. Mark Kubanek.

Photographs were taken and will be placed in MPCB's photo library.

Observations

Tailings Management Area

- The provisional line installed to transfer contaminated water from the tails pond to the water storage reservoir has been removed. Clean-up on the spill areas was initiated. A gamma survey on the line location was completed and will be forwarded as soon as completed.

- It appears KLMC will be utilizing the south half of the tailings area for winter deposition. At the time of inspection, two discharge points were being utilized on the south half on the west side. Construction of the small intermediate dike confining the tailings to one half of the tailings storage facility has not been constructed to date.

  (The report, "Performance of Tailings Deposited Under Winter Conditions" indicated tailings or Outwash Sand Material Will Be Used in Constructing the Dyke).

- The central pumping station for the supernatant and seepage collection was inspected and in operation. Mr. Kubanek indicated the optimum operating water levels in the tailings pond should be achieved in approximately 5 weeks.

Water Storage Reservoirs

- At the time of inspection both reservoirs were near full (approximately 0.5 metres freeboard), with very little capacity remaining.

- Mr. Kubanek indicated that some of the reservoir water is being drawn off and treated, and the remaining capacity in the reservoir could handle the volume of a monitoring pond should it not meet the limits, allowing release to the environment.

Monitoring Ponds

- Monitoring Pond #4 was being filled and near full at the time of inspection.

- Draining of monitoring pond #5 to the environment was near completion. A build-up of settleable solids on the bottom of the pond was occuring.

Ore, Cobble Ore Stockpile Area

- All stockpiled material was within the defined perimeter of the stockpile area.

Special Waste Area

- The special waste stockpile site remains full. MPCB are awaiting a KLMC proposal for an addition to the stockpile area.

Gaertner Pit

- The transfer of contaminated pit water to the water storage reservoirs has been discontinued. Pit water is now being allowed to flood the lower working level. (Pit bottom elevation 470, estimate to water level mark approximately 478).

- A crew was in the process of transferring water from the north east collection sump into the minewater holding area.

- Normal mining operations were in progress in the upper working platform.

Bulk Neutralization and Radium Removal Section

- A brief tour of the bulk neutralization and radium removal section of the mill was conducted by Mr. Mark Kubanek. Mr. Kubanek indicated the initial start-up and success in meeting effluent discharge limits is good.

- At the time of inspection, the vacuum precoat filters were not in operation. During a brief shutdown in the system the gypsum precipitate immediately solidified, clogging the filter leaves. Also, problems in the start-up of the drum filters is being experienced. As a result, the solids content of the tailings being discharged to the T.M.A. cannot be adjusted. Mr. Kubanek indicated the present solids content in the tailings is approximately 25%.

Sampling

Samples were collected at:

1) Monitoring Pond #4
2) Yak Creek
3) Horsefly Lake Inflow (The continuous operating turbidimeter to monitor the dewatering quality has not been installed to date).

Follow-up

1) Assess and attach sample results
2) During next month's inspection, request the operating status of the vacuum precoat filters and drum filters.

Note: a) The main function of the vacuum precoat filters is to "polish" and ensure that entrained solids in the thickener overflow are separated from the effluent. Observations made by MPCB during the final stages in draining monitoring pond #5 indicated a build-up of "settleable solids" in the bottom of the pond was occurring.

b) The objective of the drum filter section is to adjust solids concentration of tailings slurry according to the requirements for discharge. Settling tests performed on tailings material indicate that optimum conditions for sub-areal discharge technique will be achieved if the solids content is kept above 35-40%. Consequently,

should the present tailings solids content of 25% continue, KLMC should be requested to re-evaluate the conclusions documented in the report "Performance of Tailings Deposited Under Winter Conditions".

3) Inquire as to the progress on MPCB's requested report to be submitted by December 15, 1983 concerning the contamination entering the camp sewage effluent.

4) Inquire as to the progress on a MPCB request to KLMC dated September 29, 1983, requesting clarifications on a number of points made in the construction reports. (The clarifications are a request from A.P.C.B. and concern construction works relating to air emissions).

J.S. Meekma
Mines Division

JSM/ph

cc Bill Howard ✓
Joe Spross
Bill Whitehead

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date January 17, 1984

Phone 922-2220

To File

Your File

Our File U4-8-9-2

Re DECEMBER 1983 INSPECTION OF KEY LAKE MINE SITE

On December 14, 1983 Kevin Scissons and the undersigned inspected the Key Lake Mining and Milling Operation. We were accompanied on site by Eldon Krahn, Environmental Technician.. Discussions were also held with Josef Spross, Operations Manager.

Photographs were taken and will be placed in the MPCB photo library.

Tailings Management Facility

Tailings were being discharged to the pond at approximately 270 m^3/hr. The discharge site is being maintained on the south side according to winter operating procedures. Construction of the confinement dyke (tailings or sand material) to separate the north and south storage area has not been initiated. The supernatant tailings water level in the pond is being kept to a minimum as required for winter operation.

Monitoring Ponds and Water Storage Reservoirs

- Monitoring Pond #2 effluent was discharged on December 13, 1983. At the time of inspection Monitoring Pond #4 was being filled and was at 78% capacity (as noted from bulk neutralization's operator computer console.)

- The bulk neutralization and radium removal section is processing approximately 250 m^3/hr of contaminated water.

- Reservoir #1 and Reservoir #2 water level freeboard was estimated to be approximately one meter.

- As noted in November inspection report, a buildup of precipitate is evident in the bottom of the monitoring ponds. Josef Spross was questioned regarding the chemical make-up of this material. He stated that the information he has available indicates that the settleable matter is gypsum ($CaSO_4$).

Ore, Cobble Ore and Special Waste Stockpile Areas

- All material being stored in the ore, cobble ore storage area is within the confining berms.

- The special waste stockpile area remains full, all stored material is within the confining berms. The KLMC proposal for the enlargement of the special waste stockpile has not yet been submitted for MPCB approval.

Crush/Grind Facility

- KLMC continue to experience problems with the crushing and grinding of the blended ore. Problems are apparently related to the high clay and moisture content of the ore. KLMC are reviewing various options to correct the above noted problems.

Gaertner Dewatering

- Uncontaminated dewatering wells continue to discharge as per normal operation.

- The transfer of contaminated mine water from the pit to water storage reservoir #1 was re-initiated approximately two weeks prior to our inspection. A brief interruption in pumping occurred, however, pit dewatering was in progress at the time of inspection.

- The pit water level was reported to be at an elevation of approximately 475 metres. Pit bottom elevation is 470.5 metres.

Deilmann Compound Pump Test

Deilmann compound pump was initiated with the following well start-up sequence:

December 10, 1983 - Wells D-8, D-6, D-4, D-1, D-9.
December 11, 1983 - Wells D-5, D-10, D-12, D-11, D-7.
December 12, 1983 - D-14
December 13, 1983 - D-13, D-17

Wolf Lake Effluent Discharge Site

The final discharge site was inspected. The effluent discharge pipe is approximately three feet above Wolf Lake water level. As previously noted, no discharges were in progress.

Bulk Neutralization Plant Inspection

I inspected the bulk neutralization end of the circuit. I was accompanied by Darrell Hladun, Metallurgical Engineer. He indicated that the system was operating very well as far as Ra-226 was concerned. However, gypsum build-up within the circuit was causing problems with pH monitoring probes and some of the filter systems. This information supported previous discussions we had with KLMC which indicated good Ra-226 control but some problems with heavy metal concentrations.

At the time of inspection:

- 270 m^3/hr discharge to tailings pond
- 250 m^3/hr of effluent was being processed through the bulk neutralization plant. Of this, 120 m^3/hr was tailings supernatant water and 130 m^3/hr was from Reservoir #2.

- Approximately 30% solids in tailings pond discharge.

- Drum filters were inoperative.

- Vacuum precoat filters were inoperative.

Discussions

- Mines Pollution Control Branch hand delivered Josef Spross a copy of the Interim Right to Water for Phase I of the Deilmann dewatering system. Spross indicated that a separate monitoring site for the Gaertner dewatering discharge will be installed in the spring as requested by MPCB. I stated that upon review and approval of KLMC's design submission a Certificate of Approval to Construct will be issued prior to construction.

- We discussed our dissatisfaction regarding slow KLMC submission of discharged effluent quality. Spross indicated that the reports were in preparation and will be submitted as soon as available.

- We requested the Esquadat Computer Sheets for the effluent discharges. Krahn indicated that he was not aware that the computer sheets were required for effluent discharges. He subsequently delivered to us the October monitoring pond results and agreed to have all available November results in the mail tomorrow.

- Contaminated water treatment was discussed with Spross. KLMC are processing and discharging as much treated water as possible (in excess of 5000 m^3/day). The majority of water returned to the mill for treatment is coming from Reservoir #2. As required by winter

operating practice, KLMC are keeping supernatent water levels in the tailings pond to a minimum.

- Mill inspection by Branch staff was tentatively scheduled for the third week of January 1984.

Spills

An inspection report of the December 6 clarifier solution spill will be prepared and forwarded to the Spill Control Group. A copy is to be attached to this report.

Samples

Water samples were collected at:

Yak Creek	1430 hrs. 0.5°C 1150 Cond. 6.1 pH Approximately 500 gpm flow
Horsefly	1500 hrs 4.0°C 60 Cond. 6.5 pH Approximately 1.2 m^3/sec.

Follow-up

- Assess and attach sample results
- Await effluent Esquadat sheets
- Await Monthly Environmental Monitoring Report
- Confirm mill inspection date
- Await KLMC design and submission for expansion of special waste storage area
- Initiate preparation of KLMC license draft

R.G. Barsi
Mines Division

RGB/ph

cc G.W. Howard
J.S. Meekma
Bill Whitehead
Joe Spross

Government of Saskatchewan

Memorandum

From Mines Pollution Control Branch

Date January 17, 1984

Phone 922-2223

To Scott Robinson
Spill Control

Your File

Our File U4-8-9-2 ✓

Re MPCB INSPECTION OF KLMC'S DECEMBER 6 CLARIFIER SOLUTION SPILL

On December 14, 1983 the undersigned inspected this December 6 spill of 4550 litres of clarifier solution from the Key Lake mill building (east side) to verify cleanup.

No sign of the contaminant was apparent on the east side of the mill. E. Krahn of KLMC indicated the area of cleanup, but he was unable to explain the delays in initiating cleanup (excavation began 24 hours after spill), reporting of the spill (3 days) or why a gamma survey was not performed shortly after.

The area appears satisfactory and if the gamma survey displays acceptable results then no further action here is deemed necessary.

KLMC has advised the department that future "spills" will be contained following next summer's installation of an asphalt surface on the mill terrace. The mill area will then report to storm sewer lines that in turn drain to the contaminated storage reservoirs.

Conclusion

A final report from KLMC to Spill Control should explain the reasons for the delays in cleanup and the initial reporting of the spill.

The final report should also present the gamma survey results and recommendations.

Lorne Bassi /

K.H. Scissons
Mines Division

KHS/ph

POOR

QUALITY

ORIGINAL